THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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PROGRESS OF THE I.E.E.

THE *Journal* of the Institution of Electrical Engineers for July, which has just been issued, contains in its "Institution Notes" evidence of the continued activities of the Council during the recess. The most important matters before the electrical industry at the moment are the Board of Trade Reports on Electric Power Supply and on Electrical Trade after the war, and the Council has appointed a Committee to report on them, which will include representatives not only of all the more important bodies directly connected with the industry, but also of some whose connection is indirect. The titles of these bodies are given elsewhere in our columns, and in view of the breadth of selection which has been exercised, we are somewhat surprised to note the omission of certain others whose claims, as measured by the importance of the interests which they represent, are at least of equal weight. For examples, we may name the Association of Consulting Engineers, the British Engineers' Association, the Electrical Contractors' Association, and the Faraday Society. We by no means favour the formation of large and unwieldy Committees; but we are puzzled to know why some are taken and the others left. The Committee as constituted will include representatives of private interests—the British Electrical Federation and Edmundsons' Electricity Corporation—on the same basis as the I.M.E.A. and the B.E.A.M.A. But why these two? and if these, why not other important companies?

In this connection we may also draw attention to the Whitley Report, which has been generally accepted almost throughout the industrial world; while there is no obligation resting upon the Council of the Institution to take that Report into consideration in appointing the Committee, would it not be an appropriate occasion on which to put in force the spirit of the recommendations of the Whitley Committee, by inviting the Associations which represent the subordinate ranks of the industry to nominate representatives? We have in mind, in particular, the Electrical Power Engineers' Association, the formal recognition of which by the I.E.E. is recorded in the *Journal*, and the Electrical Trades Union. It is well known that the latter body, to put the matter in a mild form, is not in good odour with the electrical engineering profession, for various reasons; but we submit that that is not an adequate ground for ignoring its existence. The closer association of employers and employed, of engineers and operatives, is now one of the cardinal principles of British industrial policy; to talk about it whilst refraining from action is not merely evidence of insincerity, but also a decidedly harmful course of procedure, and we suggest that this important Committee is precisely one of those bodies upon which Labour is justly entitled to claim representation.

Another interesting item in the "Notes" relates to the promotion of the Provincial branches of the Institution from the rank of "Local Sections" to that of Territorial "Centres." We are not sure that the term is quite the best that could have been selected; while we do not suppose, in this connection, that a centre is a point within a circle, from which every part of the circumference is equidistant, it is rather startling to read "The Irish Centre to include the whole of Ireland." We grant, however, that this definition is in perfect harmony with the traditions of the Sister Isle. But in spirit this important step commands our whole-hearted approval; by their efficiency, ability, and energy the quondam Local Sections have abundantly

demonstrated the justice of their claim to rank on a footing of equality with the parent stem, and we congratulate them upon the recognition of this fact. Privileges should carry with them corresponding responsibilities, and we are glad to see that this is also recognised in the decision of the Council to delegate to the Territorial Centres some of the functions hitherto exercised only by the Council itself. Incidentally we may recall a one-time agitation for the constitution of that which was known as "The Institution"—namely, the membership attending the London meetings — as the "London Local Section"; it appears to us that the new system of nomenclature greatly strengthens the arguments in favour of this course, and we venture to suggest that the "Metropolitan Centre" be added to the list, as *primus inter pares*.

No reference is made to the status of the foreign and colonial branches of the Institution; surely something might be done to develop these on similar lines.

It is interesting to compare the development of the Institution and its sturdy off-shoots with that of the British Empire, as accelerated by the war. In both cases we find a parentage of locality, but a brotherhood of personnel, and just as the Dominions, growing in strength and influence, have advanced from the position of dependencies governed from headquarters, first to that of limited self-government, and finally to that of complete autonomy, together with an increasing representation in the Grand Councils of the Empire, so has the Institution by similar stages evolved an organisation on lines which form a remarkably close analogy with the Imperial system. The driving force in each case has been the pressure of public opinion, and thus the climax constitutes a triumph for those democratic principles the final vindication of which is the supreme war aim of the Allied Nations.

Apropos of nothing in particular, the Council tacks on to its resolution a clause relating to the co-operative formation of local Engineers' Clubs, which we are sure will commend itself to the members. We note with pleasure, too, that at the initiative of the I.E.E. a "Commercial Electrical Development Committee" has been formed, which is a separate organisation independent of any other body, and will immediately consider the development of electrical cooking and heating. This is an excellent beginning; but we hope that, as we infer from the title of the new Committee, it is only the beginning, and that the Committee will take a vastly wider view of its functions than is suggested by its nominal *raison d'être*. We hope, in fact, that we see here the germ of a new and permanent "Industrial Committee"—of an organisation which will eventually fill those gaps which are still so plainly visible in our electrical organism, and will do for the electricity supply industry in this country what the Society for Electrical Development and the National Electric Light Association have done for the United States. We shall be glad to know in due course the constitution of the new Committee, and the programme of operations which it proposes to carry out; and in the meantime, we congratulate the Council on the getting under way of developments which, though few in number, are of material importance, and must have involved a very considerable amount of labour and negotiation.

Empire Communications.

The appeal of the Canadian editors for the Empire Press Union to use its influence to secure better, quicker, and cheaper facilities for the dissemination of news throughout the Empire (Elec. Rev., July 26th, p. 74), has now been endorsed by their *confrères* of the Australian, New Zealand, and South African Press. The visit of these Colonial and Dominion leaders of thought to this country is an event of the first importance, for it has enabled them to secure at first hand, from personal observation, information concerning the munitions activity of the Mother Country, the readiness of the Fleet for all emergencies, and the operations at the battle front "over there." Something was known of these achievements and of the spirit of the Mother Country through the restricted service of news supplied over the cables; but it has required this actual visit for the whole story to be fully understood. They will return to our kith and kin to tell them many things they ought to know already, but do not. Naturally, it has been impossible to publish either here or in the Colonies, all that the newspaper man considers valuable "copy," but, apart from restrictions which have necessarily to be imposed in the interests of national security, there are other obstacles standing in the way of the circulation of information throughout the Empire. Such circumstances quite reasonably reinforce the demand that has been made again and again, in the interests of Empire life and its fullest development, for ampler facilities to be made available for telegraphic transmission of news. Nothing can do more to secure co-ordination of thought, unity of aim, interest and action, speedy conduct of commerce, and utilisation of Empire resources, than the generous provision of cabling or wireless facilities. Some of the Australian visitors, while paying well-merited compliments to the service afforded by the British cable companies, are emphatic in their references to the insufficiency of the existing cables, and want at least, and soon, the duplication of the Pacific cable. They also find the land-line charges in Australia so high as to prevent the small, and more or less distant, country papers from publishing much information. Probably this part of the handicap forms a domestic problem of their own, and one for which they can find a remedy; it is hardly a matter which we at Home can materially influence. The same remark applies to the inefficient service between their big cities, where messages, it seems, have been, during the war, taking twice the usual time owing to congestion and general inefficiency. Others of our visitors are hopeful concerning the possibilities of wireless telegraphy, while some authorities ask for two new cables across the Atlantic, one across the Pacific, and the use of wireless telegraphy up to the fullest limit of scientific achievement. There does not seem to be unanimity concerning whether facilities should be State-owned, but there is a general demand that the information communicated over them shall not be State-controlled. This view is extremely important, for it is most undesirable that intelligence transmitted from Home should be under suspicion as being subject to Government colouring. A spoon-fed Press at any time is nauseous to reputable journalists, and it is entirely opposed to democratic tendencies. Censorship there must be up to a point under conditions of warfare such as now prevail, but after the war the Press, both Home and Colonial, resist to the death any effort to shackle it—if such an effort there be. It has been pointed out by an editor from South Africa that any cable service conveying news which is to be consumed by the native races must be operated on a strictly impartial basis. Conceivably in some such cases even the statement that such a service was entirely British would not carry conviction to the native mind—it might even carry suspicion with it.

The more the subject of Empire telegraphic communication is studied and discussed the more important does it prove to be, calling for large enterprising and statesmanlike policy in ensuring, as quickly as possible after the war, the fullest, cheapest, and most expeditious means of keeping the whole of our great Family in continuous touch.

In the *Times* Trade Supplement for September Mr. Llewellyn Preece has an article on "An Imperial Cable: a True Bond of Commonwealth," in which he emphasises the importance of a full supply of Press news to all the Dominions as a means for enabling the separated peoples to enter into real sympathy with each other. He advocates "one long electric girdle round the globe" as the most economical system, and discusses the questions of cost and charges in some detail. Apparently he does not regard a wireless system as a practicable proposition, compared with cable, in respect of capacity, speed of transmission, accuracy or reliability, but he points to its being well within the realms of possibility that the speed of signalling over cables may be increased. The article is well worthy of study by those who are taking an interest in the subject. Mr. Preece remarks that if the British Empire is to be transformed into a true league of independent nations, it is above all things essential "that means shall be provided which will enable these several nations to work together harmoniously, and to ensure that intimate intercourse is established between them all. Interchange of news must far exceed that possible at present."

British Science.

The exhibition of British scientific products at King's College, which closed on Saturday after four weeks' run, proved remarkably successful, in view of the general belief that the English people had no interest in science: more than 30,000 persons paid for admission, and after a few days' experience it was found desirable to extend the hours of opening and to keep the doors open on Saturday afternoons. The exhibition was also visited by many men in uniform, who were admitted free of charge.

Prof. R. A. Gregory, chairman of the Organising Committee, expressed some disappointment that the Government had taken no official notice of the exhibition; we sympathise with him and the Committee, but are not in the least surprised. What else can be expected of a Government composed of men who know nothing of science, or, at any rate, knew nothing until it was forced upon their attention by the war? The fight is by no means over yet—the fight to secure adequate recognition for scientific work, to drive home the lesson that without science the nation cannot prosper, and to compel the educational authorities to encourage and develop the teaching of science to the utmost, in order that there shall eventually be an adequate supply of trained men to direct our industries—and our Government—on scientific lines.

We are glad to know that it is proposed to hold an exhibition of British science and invention annually in future, and trust that the idea will be carried out.

Railway Electrification.

Many causes have contributed in recent years to the development of a strong movement towards the electrification of steam railways in all parts of the world, and while, no doubt, little can be done towards this end during the war, there is every reason to believe that when peace returns this will become one of the most important and pressing questions that will then arise. Amongst the factors which have influenced the growth of opinion in this direction may be cited the urgent necessity of economising fuel, the scarcity of labour, the dearth of raw materials, and the need for improvement in transportation facilities.

In countries which possess but scanty fuel resources, or none at all, such as Switzerland and Italy, but which are blessed with an abundance of natural water power, the adoption of electric traction is obviously inevitable, and as we have noted from time to time, plans are being projected on an enormous scale to carry out schemes of a most comprehensive nature. Proposals have been submitted by the managers of the Swiss Federal Railways to the Council of Administration which involve an expenditure estimated at from £120,000,000 to £160,000,000, to be spread over a period of 30 years. In Italy preparations are under way for the electrification of the whole of the railways in the north, together with the supply of electricity for all industrial purposes on a gigantic scale. France, like Italy, already possesses a considerable mileage under electric traction, and contemplates important developments in this respect, while Norway and Sweden have carried out noteworthy schemes, and have large projects in view. In the United States we find the greatest development, for there electric traction has been put to the severest tests in main-line operation, and has been proved capable of handling the heaviest loads on stiff gradients with efficiency and reliability far in advance of steam haulage.

In all these countries large supplies of water power are available, and the arguments in favour of electrification are irresistible. But even where fuel is the only source of electric power, a very strong case has been made out for the conversion of the railways; it has been proved beyond question that very great economies of fuel result from the substitution of electric for steam power, that the number of electric locomotives required to maintain the service is far less than in the case of steam, and that important economies are made also in operating and maintenance staff and in the cost of repairs. The possibility of recuperating energy that would otherwise be expended in braking on long gradients has also been demonstrated in actual practice, and the greatly-increased traffic which can be handled on electric railways is a powerful argument in favour of the newer system.

The fact that, in the words of an American authority, "to-day electrified installations make use of the very heaviest high-speed, heavy-tonnage equipment in the world," speaks for itself; the same authority remarks that "the unquestioned reliability of this form of motive power has been proved in the severest service"; and it is reported that Mr. McAdoo, Secretary of the U.S. Treasury and Controller of Railways for the War, is seriously considering the idea of electrifying the whole of the railways of the country.

In Austria, the Ministry of Railways proposes to utilise all the water power available in the Alpine district and in Dalmatia, and to electrify as much as possible of the railways south of the Danube, on the single-phase system, which is recommended on the basis of German experience.

In this country such water powers as are available are too small and too remotely situated to affect the railway problem, except in a few localities; but none the less, the matter is of pressing urgency, for coal is at a premium and must be economised with the utmost care. Fortunately, in no country in the world, with the possible exception of Belgium, is the traffic so dense as it is in England, a condition particularly favourable to electric traction; the experience gained on every section of railway electrified up to the present has strengthened the case for electricity, and the trend of public opinion has set strongly in that direction. There is, therefore, every reason to anticipate that the matter will be seriously taken up by the authorities directly conditions permit of it, and main-line traction will soon become one of the most important functions of electricity in this country.

Coal Troubles in Spain.

According to information to hand from our Special Correspondent in Spain, the question of coal supply and distribution is again acute in that country. In Madrid the dry season has reduced the amount of electrical energy available from the hydro-electric stations, and the stand-by steam plants have been left practically without coal. In their endeavours to economise fuel the Madrid authorities discontinued the supply of energy during the early hours of the morning. This resulted in the dislocation of the production of the daily newspapers and the paralysis of many small services, both public and domestic. The general chorus of protest has forced the authorities to grant a continuous supply once more, and the Commission of Supply is now instituting a system of coal rationing which will be effective throughout the country. Naval and military factories, electric supply stations, and gas works will be granted all the fuel they need, and the local Committees of Supply will endeavour to ensure a full supply to private factories and domestic users.

The official figures of the production of Spanish coal mines during 1917 have just been published. The total production was 5,972,474 metric tons, of which 310,914 was anthracite. The output during preceding years was as follows:—

1913	4,292,522	metric tons.
1914	4,424,439	" "
1915	4,686,723	" "
1916	5,588,674	" "

The *Gaceta de Madrid* of August 18th publishes an order decreeing that in all the great centres of electrical consumption there must be committees established composed of producers and consumers, and presided over by the Governor of the Province. These Committees will make an inventory of the amount of energy used, will make reports to Madrid on the subject of local distribution and consumption, and will also propose limitations and restrictions.

In Alicante it has been decided to suspend the supply of electricity between the hours of 3 a.m. and 6 a.m., and again from mid-day till 2 p.m. In Valencia various trade unions have threatened to bring about a general strike in the city in the event of any restriction of supply being enforced.

USEFULNESS OF LOG. PAPER.

BY A. B. EASON.

THIS article is written to emphasise the value of using logarithmically-ruled paper in plotting the results of tests, and in doing various calculations. Attention is called to such paper because one so very seldom sees it used for graphs in English technical journals and scientific reports. In American and German journals its use is more common.

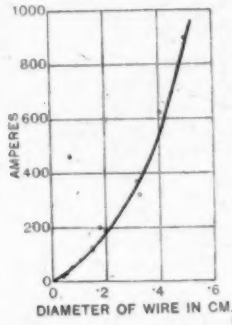

FIG. 1.—AMPERES TO FUSE COPPER WIRES IN ENCLOSED FIBRE TUBE FUSES.

There is little doubt that, so far, its value is either not appreciated by some engineers, or they are not aware of its existence.

For instance, in Clapham's "Arithmetic for Engineers," published in 1916, there is a detailed description of how to plot curves on plain squared paper; but log., polar, and

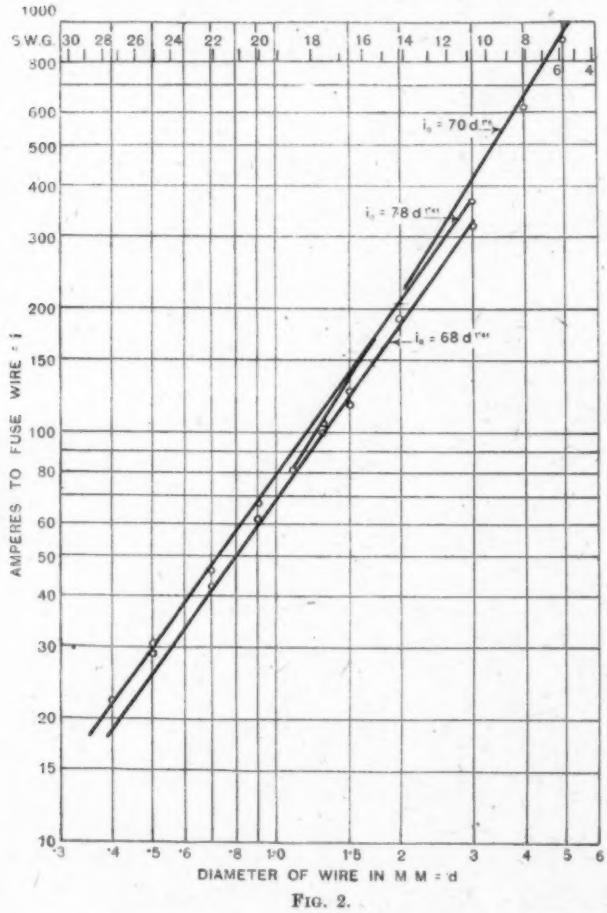

FIG. 2.

co-ordinate papers are not mentioned. By "log. paper" is meant graph, or scaled, paper with the rulings proportional to the logarithms of numbers, as on the slide rule; the ruling may be arithmetical in one direction and logarithmic in the other, or it may be logarithmic in both directions.

The advantages of log. paper over plain arithmetic-squared paper are twofold.

(*a*) Quantities ranging from 1 to 100, or to 1,000, can be plotted, and both 1 and 1,000 can be read to the same degree of accuracy; on plain paper, if quantities, say, 500 to 1,000 are shown, it will be impossible to read quantities of the order 1 to 20 or so. Compare fig. 1, which will not show accurately the fusing current for a 0·4 mm. wire, with fig. 2, which shows it to be 22 amperes.

(*b*) In many cases, graphs which are curved on plain squared paper become straight lines when plotted on log. paper; this occurs when the graph represents an equation, $y = A x^n$. A curve $y = A e^{nx}$ will be represented as a straight line on paper ruled arithmetically one way and logarithmically the other way. It would take a considerable time to find the law of the curve in fig. 1, but the law is readily visible in fig. 2.

Consider some examples plotted on each type of paper. I have calculated the probable normal fusing currents for copper wires in enclosed, or cartridge, fuses. Various sizes of fibre case and various lengths were chosen, and the different values of the fusing currents are shown in fig. 2 for any particular diameter; the lower fusing current is for the larger fibre case, and the upper one for the smaller case. The probable law which the fusing currents follow is marked on fig. 2; this could not be so easily done by inspection of fig. 1. Another example is given in figs. 3 and 4, which show the heat generated in telephone switchboard cables when traversed by various currents. The laws of heating

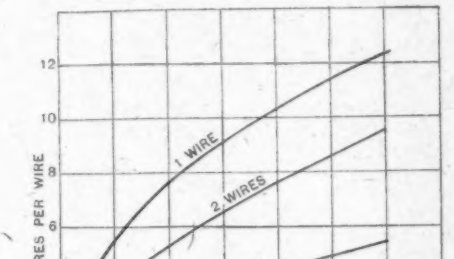

FIG. 3.

cannot be deduced easily from fig. 3, but fig. 4 shows—Watts per cm. = constant (ampere)$^{2\cdot2}$ = A $n\, i^{2\cdot2}$, where n = the number of wires carrying current. Also—

10,000 A = 4·8, 5·02, 5·2, 5·24, 5·63, 5·7,
when n = 1 2 4 6 8 12.

For any number of wires exceeding 12 one may say that—

Watts per cm. = 0·00057 $n\, i^{2\cdot2}$.

One can easily interpolate the values for 11, 10, 9, 7, 5, 3 wires by drawing straight lines on fig. 4; it would take much longer to draw in suitable curves in fig. 3.

If no printed log. paper is available, and one has results which might usefully be plotted on log. paper, one can plot the numbers on ordinary closely-ruled squared paper, using one's slide rule as the scale; if the numbers are to be plotted with log. scale both ways, this is a poor makeshift. Paper could also be ruled locally, using either the slide-rule divisions or by direct calculation from the values of the logarithms.

In various reports in English technical journals, one comes across graphs plotted on plain squared paper, but the logs. of the quantities are plotted instead of the quantities; this gives exactly the same straight line or curve as would be given on log. paper; but the meaning of the graphs are not so clear as when the values of the numbers are placed against the scales. Further, if the curves are being used, one must have log. tables or the slide rule to convert the points on the curve to actual quantities.

Now as to the method of getting log. paper. There are

at least two kinds of log. paper on the market, viz., with rulings 1 to 10, and with rulings 1 to 100. Larard and Golding in "Practical Calculations for Engineers" (Griffin, 1914), mention the first type of paper, and show how numbers varying between, say, 50 and 350 can be plotted on such paper by dividing them all by 50, so as to bring the variations between 1 and 10; it is far preferable, however, to plot the numbers directly, viz., on paper which has rulings

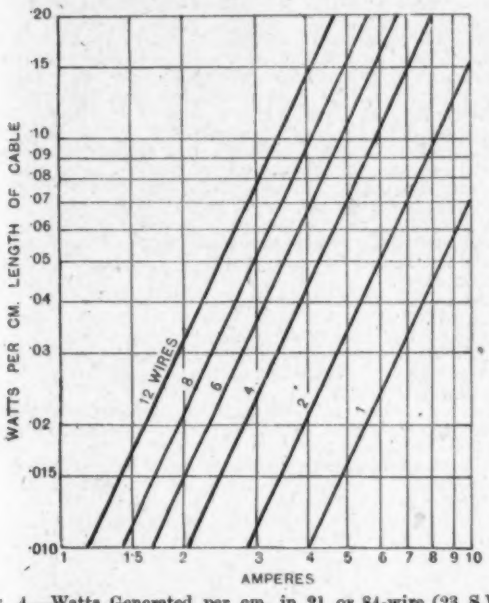

Fig. 4.—Watts Generated per cm. in 21 or 84-wire (23 S.W.G.) Cable by various currents circulating in various numbers of wires as shown. Watts = (constant) (ampere)^{2}.

showing 50, 100, up to 1,000; to do this one must have paper ruled 1 to 100, or 10 to 1,000; then values of the graph can be read off directly without having recourse to any multiplier. Log. paper ruled 1 to 10 is obtainable from Pye & Co., Cambridge, and from Mallandain, 51, Cheapside, London; paper ruled 1 to 100 is obtainable from A. G. Thornton, Ltd., King Street, Manchester. There may be other sources of supply, and, if so, I should be glad to hear of them.

NEW ELECTRIC FURNACES.

An article by Messrs. H. W. Gillett and A. E. Rhoads in the *American Machinist* of August 24th, 1918, describes a new type of electric-arc furnace developed by metallurgists of the United States Bureau of Mines.

With the huge tonnage of brass required for war purposes, the use of the small units—averaging 200 lb. per charge—in which crucible melting is done by the brass rolling mills is an anachronism. Besides the avoidance of crucibles and the ability to melt larger charges, electric melting (in a suitable type of furnace) decreases the loss of metal by oxidisation and volatilisation, prevents the taking-up of sulphur from the fuel, gives better and more healthful working conditions, and has many minor advantages, such as freedom from handling and storing fuel and ash. Electric furnaces give crucible quality of metal without using crucibles.

However, not every type of electric furnace can be used for brass melting. Brass is made up of copper and zinc, and zinc is volatile at brass melting temperatures. The direct-arc type of electric furnace used for steel melting, such as the Heroult, can be used only on bronzes practically free from zinc, because of the high local temperature of the melt under the arc.

Indirect-arc furnaces, such as the Rennerfelt, can be used on brasses carrying up to about 20 per cent. zinc, but are not suitable for ordinary yellow brass on account of the formation of a superheated layer on the surface of the melt directly under the arc, and the resulting volatilisation of zinc.

Induction furnaces of the ordinary horizontal-ring type, like the Rochling-Rodenhauser, cannot be used on brass or bronze because the high electrical conductivity of these alloys requires a secondary current so high that the "pinch effect" causes rupture of the secondary ring.

Hence it has been necessary to develop types of furnaces radically different from those in use for steel in order to meet the requirements of brass.

At the Chicago Bearing Metal Co.'s works two 1-ton Snyder and two 1-ton Rennerfelt furnaces are melting bronze for railroad bearings, high in lead, but practically free from zinc. The metal losses are not much reduced from previous practice in crucibles and open-flame oil furnaces, but the furnaces are making savings in melting cost as compared with either the crucible or the open-flame furnaces under present conditions.

The Philadelphia Mint is melting nickel and coinage bronze in a 1,000-lb. Rennerfelt furnace. The Gerline Brass Foundry Co. melt Monel metal, red brass, and brass containing up to about 20 per cent. zinc in an 800-lb. Rennerfelt.

The Baily furnace uses a single-phase granular resistor, the heat from which is reflected down on to the hearth from the

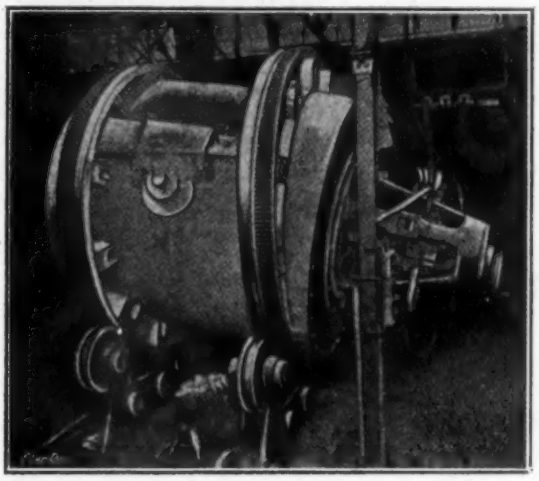

Fig 7.—Rocking Electric Brass Furnace.

roof. It takes charges of about 1,000 lb. This furnace is applicable to alloys of any zinc content, reduces metal losses, avoids crucibles, and gives good working conditions. The main drawback of this type of furnace is that the source of heat is not close to the melt, and the heat must be reflected down from the roof.

The Ajax-Wyatt furnace is a single-phase induction furnace in which the secondary ring is in the form of a loop below the level of the hearth proper, so that the hydraulic head of the metal in the hearth opposes the rupturing effect of the "pinch" force, thus avoiding the troubles that make horizontal-ring induction furnaces inapplicable to brass.

The metal heated in the secondary loop is constantly ejected at one part of each opening from loop to hearth, and colder molten metal drawn in at another part of the opening. These fountains of hot metal issuing from the resistor melt the charge in the hearth. The constant circulation of metal is a most desirable feature, and gives a product of remarkably uniform chemical composition.

Because of the compactness of the furnace, the generation of heat within the metal itself, and the stirring action, vertical-ring-induction furnaces are extremely efficient as regards power consumption. The power factor, in the sizes so far built, is satisfactory. The furnace must be started with a charge of previously melted metal, and sufficient metal to fill the loop must be retained when pouring. The metal in the loop must never be allowed to solidify, or the lining will be ruined. These facts make it difficult to change from one alloy to another, and require that the furnace be run 24 hours a day, or else receive enough power at night to keep the metal in the loop fluid. No lining has yet been found that will withstand alloys containing over 3 per cent. of lead and the furnace has been developed mainly for yellow brass. The furnace saves zinc, avoids crucibles, and shows so low a power consumption on 24-hour operation that it can doubtless be used to advantage in rolling-mill practice, even under normal prices of fuel and crucibles.

Besides the four types mentioned above, each of which has found commercial use where conditions were suitable, there are four other furnaces that have reached a semi-commercial stage, but are still under experimental development.

None of these types seems quite fitted to that common set of conditions where a furnace may be called upon to melt successive heats of alloys differing widely in composition, to handle both alloys free from zinc and those high in zinc, and to operate cheaply on a 9- or 10-hour day.

In its study of electric brass melting during the past five years, the Bureau of Mines has developed a rocking-type of furnace, which may perhaps help to fill this gap.

In the ordinary indirect-arc type of furnace, the heat is applied above the melt, and as hot metal is lighter than colder metal, there is little circulation in the bath. In an alloy high in zinc the surface will reach the boiling point of

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the zinc while the bottom is scarcely melted. Such heating creates a high pressure of zinc vapour within the furnace, so that if it is not tightly closed zinc is lost continually. If the furnace is sealed tight, the pressure may even blow out the roof or door. In case the furnace holds tight and the pressure is not relieved till the spout is opened for pouring, a long hissing stream of zinc vapour then shoots out, burning in the air. This local overheating is the cause of the failure of the indirect-arc furnace to handle alloys high in zinc without large metal losses

The obvious way to overcome this trouble is to stir the melt so vigorously that the temperature of the melt is practically uniform, and the superheating of the surface prevented. The most practical way to stir the melt is by the principle of the cement-mixer, by turning the furnace bodily, so as to stir the contents thoroughly while being heated. Constant rotation of a cylindrical furnace placed more or less horizontally, but preferably at a slight angle with the horizontal to produce endwise motion of the melt during rotation, with electrodes entering at the ends of the drum and an arc struck between the electrodes, should not only stir the charge thoroughly, avoid surface over-heating, and thus prevent zinc losses, but should also give a well-mixed alloy. By washing the walls with metal the heat stored in the walls and roof should be largely taken up in the metal instead of passing out. The power consumption should therefore be low. As the walls are washed with metal their temperature can rise but little above the temperature of the metal, which should give a good life of lining.

Instead of rotating the furnace through a complete revolution, which would involve difficulty in keeping the metal out of the joints between the door and the door opening, as this opening should be on the circumference of the drum rather than on the end, and in making brush contacts to the electrodes, it appears simpler to rock the furnace back and forth so that the molten charge just fails to reach the door at either end of its rocking angle.

Laboratory tests having demonstrated the probable usefulness of this type, a furnace of commercial size was designed. The Detroit Edison Co. refined the design, made the working drawings, constructed and erected the furnace, which is shown in the accompanying illustration.

The drum is 5 ft. in diameter by 5 ft. long. The lining is 12 in. thick, and consists of Sil-o-cel brick on the outside, special heat-insulating brick in the middle layer and corundite brick (a very refractory firebrick high in Al_2O_3) as the actual hearth lining. The hearth is 3 ft. long by 3 ft. in diameter, taking charges of 1,300 lb. and upwards. The electrodes are 4 in. diameter graphite, threaded for continuous feed, and are adjusted by screw-operated supports of the lathe-slide type. Single-phase, 60-cycle current, stepped down to 120 to 130 volts, is used, 30 K.V.A. being available. Electrode adjustment is by hand, and to stabilise the arc an external reactance is used which brings the power factor of furnace plus reactance, measured at the furnace switchboard, to about 0.85. The open-circuit voltage falls to about 106 to 116 volts under load. The current varies between 1,000 and 2,000 amperes, 1,650 amperes being about the average. The power input can be varied by altering the length of the arc, and runs from 100 to 200 KW., averaging about 165 KW.

The flexible leads and the water hose for electrode cooling are given slack to allow of rocking the furnace.

The rocking of the furnace during melting is done automatically by means of a control device which can be set to give a "safe rock" of 80 deg., the limit of motion being such that the metal just does not run into the spout. After the charge has begun to melt, the "safe rock" is started. It is called the "safe" rock because the angle is such that solid charge will not fall on the electrodes and break them. A complete oscillation on safe rock takes 13½ seconds.

During the safe rock the solid metal is washed about in the molten part of the charge, and is tumbled over, so that fresh surfaces receive direct radiation from the arc. As melting goes on, the rocking angle is increased by turning the handle of the control device from time to time, until, when the metal is all melted, the furnace is on the "full rock" of about 200 deg. On full rock the metal washes the whole circumference of the hearth save the height of the charging door and a few inches above and below it, so that metal does not splash into the door joint. A complete oscillation takes 33½ seconds.

The reversal of the 5-H.P. motor at either end of the rocking angle is done by contactors, operated by solenoids actuated by the contacts on the control device.

When it is desired to depress the spout past the limiting point of the automatic rock, for pouring, the control device is switched out and the solenoids are operated by a reversing switch.

From 102 tons of metal melted in strict comparison with coke-fired crucible furnaces, the rocking electric furnace produced 1.8 per cent. more metal from the same charge than did the coke fires. The alloys melted ran from 90 per cent. to 66 per cent. copper, 1 per cent. to 9 per cent. tin, 1½ per cent. to 26½ per cent. lead, 0 to 30 per cent. zinc.

There was no difficulty in draining the metal completely from the hearth, and alloys of different composition could be made one after the other without contamination by metal remaining from the previous heat.

On the basis of power read on the high-tension side of the transformer, the consumption was, with 10-hour operation, 396 KW.-hour per ton, on red brass poured at 1,180 deg. C. average temperature. For 24-hour operation the figure is about 260 KW.-hour per ton for red brass.

The electrode consumption was 1½ lb. per ton, equivalent to about 40 cents at present electrode prices.

As near as can be estimated, the relining cost for labour and material should be well under 50 cents per ton with a corundite lining when melting red brass poured at 1,150-1,200 deg. C. If only yellow brass, poured at 1,100 deg. C. is melted, the lining cost will be still lower. If very hot bronze is to be produced, say at 1,300 deg. C., the roof and upper portions of the ends should be lined with zirkite bricks.

Accurate temperature control is very easy in the rocking furnace, since at the end of a heat, after the "full rock," the walls are no hotter than the metal, and there is no heating-up of the charge from hotter roof and walls when the power is shut off, as is the case with those types of furnace where the heat is reflected downward from the roof. After cutting off the arc, the temperature falls very slowly, about 2 or 3 deg. C. per minute. By running the arc a minute or so every 10 or 15 minutes, a charge can be held at pouring temperature for an indefinite period.

One man can operate the furnace, with the aid of a helper while charging. Were automatic electrode control used, which could easily be done, one man could probably attend to two furnaces.

The output per man-hour was greater from the rocking furnace than from the coke fires. The working conditions are much less severe and more healthful with the electric furnace than with the coke fires, and a man of less rugged physique than is required for coke fires can readily operate the rocking furnace.

Various modifications and improvements in design are being incorporated in other furnaces of this type now being built for Detroit firms.

Comparing the cost of melting on a 10-hour schedule in the rocking electric furnace and in the coke fires of the plant at which the test was made, the sum of the cost per ton of charge for electric power, interest and depreciation, electrodes, linings, and for heating ladles, is just about one-half of the cost per ton of charge of the single item of crucibles at present prices and at present crucible life. The value of the metal saved by the electric furnace is about twice the cost of the coke used by the coke fires. Hence a huge saving is possible by electric melting under present conditions; and even at pre-war prices for crucibles, coke, and metals, the rocking furnace will show a smaller, but still a distinct, saving. On 24-hour operation the balance in favour of electric melting is still more marked.

The rocking-furnace is somewhat more efficient than the direct-arc and unrocked indirect-arc types, very much more efficient than electric furnaces of types in which heat is reflected on to the charge from the roof, and very little less so than the induction furnaces.

In magnitude of metal losses, the rocking furnace gives at least as good results as any other type of electric furnace. The only possible loss is from the stream of metal while pouring, as the furnace is sealed tight while running. Volatilisation from the stream while pouring is, of course, about the same in all types of furnaces.

In closeness of control of the temperature of the melt the rocking furnace is superior to any save the induction type. In thorough mixing of the charge, the rocking type is about on the same plane as the induction type, and markedly superior to the other types, where, in large sizes, segregation in the bath may be a serious problem.

From the electrical point of view, the rocking furnace does not have so steady a load, and hence, on this core, is not so desirable as the induction furnaces or granular resister furnaces. It does not require special transformers, as the granular resister type does. It lacks the electrical advantages of multiphase furnaces. In first cost, the rocking type should be no more expensive than other electric furnaces.

At the conclusion of the tests conducted by the Bureau of Mines, which covered over 300 heats, the experimental furnace was put on regular production by the Michigan Smelting & Refining Co. Four 1-ton rocking furnaces are being built for this company and two for the Electro Bronze Co.

(To be continued.)

South Africa.—ELECTRICITY IN WATERWORKS.—The report of the Rand Water Board for the past year states that the electrolytic production of chlorine for sterilising water turned out successfully, the cost being equal to chloride of lime at £18 per ton, whereas the local price is £50 per ton. The plant is now to be placed nearer the reservoirs, and even better results are expected. The Board has now two electrically-driven Sulzer pumps at the Zuurbekom station, each capable of raising 5 million gallons per day, and a new turbo-centrifugal pump, capable of raising 5½ million gallons per day, against a head of 1,100 ft., is to be installed at the Zwantkopjes station. As a precaution against damage by electrical disturbances, the electrical plant at the pumping station is now shut down during thunderstorms; last year damage to the extent of £166 was done to the plant, which was shut down for a total of 159 hours, on 97 occasions.

ELECTRIC POWER SUPPLY IN BRITISH EAST AFRICA.

A Bill dealing in a comprehensive manner with electric power supply is now awaiting its final reading in the Legislative Council of the Protectorate. The measure is designed to foster and promote bulk supply methods, and to ensure standardisation.

Public and local authorities must adopt the Standards and Specifications of the British Engineering Standards Committee. The standard system for the Protectorate will be three-phase at 50 periods, excepting for special purposes, and, excepting the supplies to authorised distributors and for special purposes, the pressures of supply will be 415 and 240 volts.

All apparatus to be used in connection with a standard system, by a licensee, must comply with these standards, and that which may be used by others on a standard system must be marked when usual or necessary as to its capacity or value, in terms of British standards.

Practically every form of energy which industrialists in the Protectorate will require must be obtained from or by the conversion of electrical energy generated by water power, internal-combustion engines, or oil-fired boilers. Consequently, a demand for apparatus is developing which should not be neglected by British manufacturers.

The Government Electrical Engineer (Mr. James McBlain) will be pleased to receive catalogues and other information, with prices where possible, relating to hydraulic, internal-combustion, and steam types of prime movers, electric generators and motors, transformers, E.H.P.-transmission line materials, split-phase and other control and switching apparatus, indicating and recording meters, testing and measuring apparatus, &c.; also relating to apparatus for any industrial application of electrical energy, including farm and electroculture equipment, electrolysers, ozonisers, automobiles, batteries, and battery-charging, coffee drying and roasting, steam raising, mashing and distilling, casting and welding, cement burning, domestic heating and cooking, and X-ray and electro-medical equipment, &c., &c.

Inquiries from those interested are solicited, and should be addressed to the Government Electrical Engineer, Nairobi, British East Africa.

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

(*Continued from p.* 222.)

Siemens Brothers & Co., Ltd., London.—Included in the electromedical apparatus exhibited by this firm is an X-ray outfit for a general practitioner, suitable for operation with direct current, the apparatus being fitted with a mercury interrupter, 12-in. spark induction coil, and switchboard. The coil is mounted upon a pedestal, and the whole apparatus forms a most convenient installation for use either in a general practitioner's consulting room or a small hospital, as it obviates the necessity of setting apart a large room for the accommodation of an X-ray installation. The main portions of the apparatus are in a compact and convenient form. The induction coil is mounted on the top of the wooden screen, which is adapted to form a protective screen for the operator. This is accomplished by lining the inside with lead and fitting a lead-glass observation window. Beneath this window a switchboard is fitted on which are mounted the variable resistance, switches, measuring instruments, &c.; a shelf is provided for the mercury interrupter so that the whole of the combined apparatus, including the induction coil, switchboard, mercury interrupter, and overhead wiring for the X-ray tube can be wheeled into position for work and afterwards wheeled back into a convenient corner of the room.

The diathermy apparatus forms a convenient method of producing high-frequency currents for use in electrotherapeutics; it enables the temperature of the body to be raised in the treatment of diseases, the deeply-seated regions of the body being heated, not merely the superficial tissues. The apparatus consists of the necessary transformer for raising the pressure to about 2,000 volts, a spark gap similar to that which is used for wireless telegraphy, a hot-wire ammeter, variable inductance, adjustable resistance, and condensers, all being suitably arranged on a table fitted with large castor wheels to render the apparatus tractable.

There are also shown rotary converters of 2 K.V.A. capacity for converting from direct-current supply to alternating current, for use with the diathermy apparatus, and consisting of a Siemens standard semi-enclosed protected type machine with two bearings fitted in end shields.

Another exhibit is a mercury interrupter (new model), complete with motor, fitted with switch for varying the number of interruptions per revolution, and another switch for adjusting the time of the "make" current, complete with gas taps for connecting to a gas supply for use with a gas dielectric.

A heliodescent lamp outfit has considerable therapeutic value, its chemical and heat radiation having been found very advantageous in the treatment of many complaints. It is very abundant in ultra-violet and violet radiation, as the filament glows at a very high temperature. The outfit includes a large nickel-plated reflector fitted with a wooden handle to enable the lamp to be moved into position for treatment. The reflector is suspended from a bracket so that it can be adjusted in any direction and then secured by the clamping screws provided.

A quick-break foot switch (improved model) is designed so as to enable the X-ray operator to darken the room automatically while screening the patient and at the same time to switch on the current for working the X-ray installation, or *vice versa*.

The Coolidge control outfit exhibited is intended for use with a Coolidge tube to provide by means of a small generator the necessary energy for heating the filament. This motor generator is adequately insulated and mounted on porcelain feet; it has an output of 5 amps. at 12 volts.

A screening stand is shown provided with large protected tube box, diaphragm, counter weights, and adjustment for holding the fluorescent screen and plate holder. This means of adjustment is of great use when screening a patient in a vertical position. The tube box is arranged so that it can be used either in the vertical position in conjunction with the stand or in conjunction with a simple table for horizontal radiography.

The "Simple" X-ray couch is fitted with a compressor for arresting the movement of internal organs during radiography, and is arranged with stereoscopic scales for localising foreign bodies.

The Rapid Magnetting Machine Co., Ltd., Birmingham, is exhibiting photographs of the "Rapid" (Thompson-Davis patent) electro-magnetic ore separator (fig. 7), together with samples of minerals magnetically separated by the machine, and also samples of the same minerals before separation. In the case of the minerals of different colours the clean separation can be judged quite readily even by the uninitiated person. Before the war the manufacture of magnetic separators for feebly magnetic ores had been practically the monopoly of two German firms, but the exhibitors can now offer an apparatus

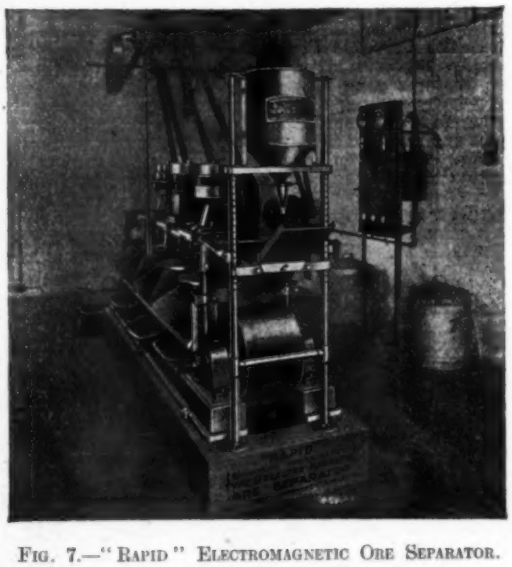

Fig. 7.—"Rapid" Electromagnetic Ore Separator.

which they will guarantee to give equal separation to that obtainable on the German apparatus. It may be constructed to remove first highly magnetic material, and iron, and afterwards products of varying magnetic permeability. It is made with two, three, and four poles with two or three separating disks. Briefly described, it consists of powerful vertical electromagnets stationed under a travelling feed belt, on to which the material is delivered, passing the poles successively. Above the belt, at a suitable distance from the first pole, is a horizontal revolving iron disk of larger diameter than the width of the belt. The edges of this disk are magnetised by

induction sufficiently to attract iron and highly magnetic material from the ore on the feed belt, which, as the disk revolves, is carried on its edge out of the magnetic field, and, when overhanging the belt, falls off by gravity and is there collected. The ore passes along until it reaches the next revolving disk, which is situate above and between the two magnet poles, where the magnetic lines of force are concentrated through the feed belt and ore to the disk, which is shaped so that an intense induced magnetic field is produced on its edges on that section actually over the magnet poles, attracting the feebly magnetic material, and depositing it whilst overhanging the edge of the feed belt where the magnetic influence is nil. As the ore passes the edges of the revolving disks successively it is subjected to the influence

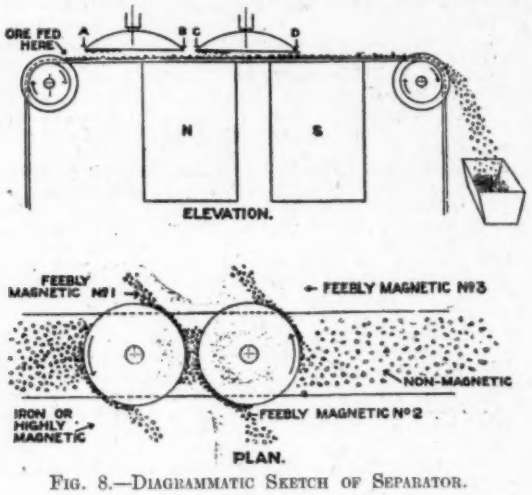

Fig. 8.—Diagrammatic Sketch of Separator.

of the magnet twice at one passing, and by the introduction in tandem of the extra pole pieces and disks of suitable construction, the number of magnetic products can be increased. It is also possible to arrange the disks in such a manner that two distinct products can be obtained from each disk. The "Rapid" machine is provided with adjustment by which the angle of the disk can be regulated relative to the feed belt; the disks may be adjusted vertically and the magnet poles laterally; the speed of the feed belt is variable; the strength of the magnets is controllable by rheostat; the automatic feed is adjustable to suit any grade of ore; and lastly, all adjustments can be made whilst the machine is running.

(To be concluded.)

Lectures.

The British Scientific Products Exhibition, which closed on Saturday, September 7th, has been an unqualified success from whatever point of view it is considered. The exhibits gave a fairly representative idea of the progress made in this country in the application of scientific and industrial research, and it would be a great pity if efforts were not made to follow up the initial success achieved by the British Science Guild. It is not generally known that the entire financial responsibility of the exhibition was undertaken by the British Science Guild without the support of any of the Government departments, and it is rather a sad reflection that none of the Ministers whose departments are concerned with industrial questions found even the time to pay the exhibition a visit.

One feature of the exhibition has been a series of lectures. A wide range of subjects has been covered by the various lecturers, and a great deal of interest has been aroused in the problems discussed. In the course of a lecture delivered by Mr. A. Newlands, M.Inst.C.E., engineer-in-chief of the Highland Railway, the question of developing the water resources of this country was discussed. Mr. Newlands holds the view that not only will the development of our water resources provide us with the energy that we require, but its proper development is to some extent bound up with the reorganisation of our industrial life. Cheap power and a greatly extended use of it is an imperative necessity, and the continued neglect of the water-power possibilities of this country is a very serious economic waste. In the latest Census of Production Report it is shown that while the total horse-power of industrial engines in Great Britain and Ireland is approximately 10¼ millions, of this only 178,000 H.P., or 1.6 per cent., is represented by water power. In Mr. Newlands's opinion water-power could very easily be drawn upon for one to one and a half million H.P., or over 10 per cent. of our requirements. It is estimated that while there is available for development from water-power in Great Britain 10.9 H.P. per square mile of area, only 0.91 H.P. is actually utilised. Mr. Newlands is of the opinion that the place of water-power in industry lies in the utilisation of it as far as possible in territory where industrial activity can be recreated, or where none ever existed. This raises a very important sociological problem which it is desirable that our scientists and engineers should consider in a serious spirit. The energy derived from water power can be transmitted electrically over large areas, and made available where practicable for the varied requirements of agriculture, both in the field operations and in the farm buildings. Here it would help to eliminate much of the drudgery of this important industry, while at the same time coming into service for the purpose of rural transport. As regards industries, it is only necessary to mention the manufacture of aluminium, the electrochemical industries, and the fixation of nitrogen to show what enormous possibilities exist in the development of these industries by the application of the large power supplies which would be made available by the utilisation of water. The saving of coal, too, through the development of our water-power resources, is an item the importance of which cannot be over-estimated. But this is not the only consideration, for it has distinct and far-reaching possibilities and advantages of its own, and if, as is generally believed, we must enormously increase our national production to re-establish our national position, the utilisation of water power will be necessary.

Mr. L. Gaster, in a paper on illuminating engineering in peace and war, claimed that the provision of appliances for artificial lighting was essentially a "key" industry. Since the outbreak of the war, he said, considerable progress had been made, and manufacturers had triumphed over many difficulties. This was particularly noticeable in regard to electric incandescent lamps, carbons for arc lamps, and other essential commodities. The obtaining of tungsten from the ore is being done in this country on a far greater scale than before the war. Apart from the manufacturing side, Mr. Gaster laid great stress upon the study of the proper use of light, its application to various problems, and its distribution.

In radiology the outbreak of war found a condition of unpreparedness in common with other branches of medicine. Adequate staffs and large quantities of new apparatus had to be provided for many new departments. Dr. Robert Knox described this state of affairs in a lecture on the practical uses of radiography. The backward state of the industry described as prevailing four years ago is all the more remarkable when it is remembered that although X-rays were discovered by Prof. Röntgen, the discovery could not have been made but for previous scientific research carried out in England. Further, since the original discovery of X-rays, the two greatest advances in this connection were in a large measure due to professors at King's College, the original Crookes "focus" tube having been adapted to X-ray purposes by Sir Herbert Jackson, and the Coolidge tube, though brought out in the U.S.A., was based on the experimental results obtained by Prof. O. W. Richardson working on lines laid down by Sir J. J. Thomson, of Cambridge. The importance of the industry associated with radiography is great, and it promises to become greater in the future. Dr. Knox stated that experience gained in the administration of X-ray departments on a large scale, such as had been possible during the war, had taught the necessity for the standardisation of apparatus. The task of rapidly equipping numerous departments would have been easier, and the standard of work done better, had this standardisation of apparatus been achieved before the outbreak of war. If we are to hold our own in competition after the war, research work must be carried out in connection with the production of essential apparatus and X-ray tubes. This need was emphasised by the lecturer, who stated that lately important research work had been carried out in this country. Dr. Knox stated that the intensifying and fluorescent screens at present in use were an advance on those formerly imported. Manufacturers of X-ray plates had more than held their own, and the production of a trustworthy photographic paper upon which X-ray negatives could be produced directly was one of the achievements of the war period. Dr. Knox described the most striking of recent applications of X-rays and radium as that used by Mr. Percival P. Cole in connection with his operative work on injury to the face and jaws. Mr. Cole's name was also associated with another new development in plastic surgery, the depilatory power of X-rays having been used to destroy hair in portions of the scalp and face which were used in plastic surgery. More than once in the course of his lecture Dr. Knox insisted on the need for encouraging research and bringing about the co-operation of all interested in the work. He said that steps were in progress with a view to forming a British school of radiology and physicotherapy.

In the course of a short lecture on electrical development after the war, Mr. C. H. Wordingham, C.B.E., President of the I.E.E., said that the term electrical industry was a very wide one; it embraced many industries, and electricity was invading all other branches of engineering. No engineer would in the future—he might almost say in the present—be able to perform the duties of his branch without some knowledge, and in many cases an intimate knowledge, of electrical science. Electrical development had made rapid strides, as was evinced by the uses to which electricity was put on board ship, especially in the case of warships and submarines. On a modern battleship electricity was made use of in almost every conceivable manner; the progress that had been made with the electrical propulsion of ships,

especially in America, was very promising, and this would be more widely adopted when hostilities ended.

In the works and factories here in this country electricity had played a great part during the war; it would not have been possible for our munition works to produce the output they had done without the aid of electricity. Another recent development was the electric furnace; it was an important application of electricity, and had made large strides. After the war it would make still greater strides if a cheap and abundant supply of electricity were available. Again, the electrical driving of rolling mills was a further development that had made headway recently; this was important inasmuch as it showed what electricity was capable of doing. A steel rolling mill performed the hardest and most trying work that any machine was called upon to do, and this was done efficiently by an electrical drive.

The Admiralty was a large user of electricity; it was made use of in almost every conceivable manner. It was used in many ingenious ways for detecting the enemy's movements and intentions both on land and sea. Recently a submersible electric pump had been developed which was extensively used for salvage work, and it had accomplished very good work indeed.

After the war it would be necessary that there should be an abundant and cheap supply of electricity. At present there was a large number of small generating stations, and only very few large ones, such as those at Manchester, Birmingham, and Glasgow. To the small stations a large amount of credit was due; they had done pioneer work, and had paved the way for the so-called super-station, about which we are hearing so much just now. But the time had now come when it was necessary that these small stations should be superseded; it was not intended that they should all go at once; the most inefficient would be done away with first, and the process would thus be a gradual one. The advantages that would accrue from such a scheme would be an improved load factor, larger individual generating units, the location of the station could be chosen independently of the area to be supplied, and, lastly, there was the question of fuel economy. It was absolutely essential that our irreplaceable fuel supplies should be conserved, and the super-station scheme would help largely to bring this about. A combination of gas works and central electric generating stations would produce cheap power, and at the same time conserve fuel by enabling the by-products of the coal to be reclaimed. There were some areas where a cheap supply would never be available, nevertheless it was necessary that a supply should be available in all areas—in the country districts for agricultural purposes, as well as in the densely-populated ones for manufacturing. It would be necessary, therefore, to set off the cost in one place against that in another, so that a low price might be charged over the whole country. In his opinion, electricity could be generated on a large scale profitably, and sold to consumers at a low price. Further benefits that would result from this super-station scheme would be the standardisation of voltages and periodicities, and therefore also of apparatus. This, in turn, would enable manufacture to be carried out on a large scale in a uniform manner. At the present time too many manufacturers were making the same mistake; they were trying to cover too much ground at once, and producing too large a variety of articles. It would be a misfortune if combines were formed and the small firm swept away. In his opinion, there was plenty of room for a few large concerns and the small ones as well. The differences and jealousies that existed in the past would have to be swept away, and the small firms should combine in such a way that each firm could restrict itself to the manufacture of one class of apparatus, for which it was best equipped, and of which it had most experience. In this way they would obtain better results, and would be able to present a united front to tackle the home and foreign markets.

Since the commencement of the war it had become apparent that very few people in this country understood the importance of key industries, or even realised that such industries existed. Germany, however, fully appreciated the position, and took advantage of it. As an illustration of this, the manufacture of carbon electrodes could be mentioned. Only one firm was manufacturing carbons in this country prior to the outbreak of war; it was done for many years at a loss, but, by the help of the Admiralty, both with grants of money and scientific advice, this firm was able to continue manufacturing in spite of all opposition and competition. The Admiralty was the only department that foresaw the serious position that would arise were the supply of carbons to be cut off; it therefore insisted upon a supply of British-made carbons being available. Another Government department attempted to follow the example set by the Admiralty, but it go itself into trouble, and the attempt had to be abandoned.

The magneto industry was another that could be mentioned; only those who understood how difficult it was to manufacture such a highly-complicated machine as a magneto would appreciate the difficulties that had had to be overcome. It was largely due to an officer in the Royal Naval Air Service that we were at present successfully manufacturing magnetos in this country. Insulating material was another very important commodity; every branch of the electrical industry depended upon it, and in that respect we ought to be entirely self-supporting.

The prospect for the development of the electrical industry after the war depended to a large exent upon labour; it was a question of whether labour (both head and hand labour) was prepared to put its shoulder to the wheel and produce in large quantity or not. There was a large amount of latent ability amongst the labour class; one only had to look at some of the Labour leaders to understand what labour was capable of as a class. Labour should be given a larger share, not only in the profits, but also in the direction of affairs. If Labour was allowed to see and know more of what went on behind the scenes, he firmly believed that many of the difficulties and misunderstandings that were constantly cropping up at present would entirely disappear. The Government only recognised those who were organised; engineers had therefore realised that they must organise themselves as the men that they controlled were organised; this they had decided to do, and it would shortly be accomplished.

Mr. C. A. Darling, lecturing on high-temperature processes and products, described the various methods of welding. This had superseded the old blacksmith's method, and foreshadowed the passing of riveting. It provided a new opening for partially-disabled soldiers, many of whom were welders. Electric arc welding had made great strides during the war; the rivetless ships were now being constructed by the use of arc welding, and American investigators were of the opinion that we were ahead of America in this matter. There was a striking increase in the number of electric furnaces for smelting, and though the cost of power was high, it was compensated for by the superiority of the high-class steel that was obtained. He suggested that high temperatures might displace the centre of gravity of our industries, for if super-power stations were established in London, as had been proposed, London might become a steel centre. He called attention to the various products of electric high-temperature furnaces, some of which had been neglected. But power could now be got as cheaply at Tyne-side as at Niagara, and there was no reason why we should not manufacture the same products. A college of research into electric furnace products was needed, for the subject offered vast possibilities for the future.

Dr. W. Rosenhain, in the course of a lecture on aluminium and its alloys, said that lightness itself was of little value; what was wanted was a combination of lightness and great strength. There were many moving parts in light machinery in which the extensive use of light alloys would appear to offer a large field for real advance. Aluminium and its alloys demanded the serious attention of British and Imperial industry. For aircraft and military purposes it had the importance of a key industry, and it was an industry which must not be neglected.

Mr. J. L. F. Vogel, lecturing on tungsten, said that the attempt to make tungsten in England before the war was no sufficiently determined. He himself had been connected with Dr. Stenhardt in running a small factory in London, where about 300 tons were produced, but the company lost money, as it was impossible to meet German competition. During the period 1906 to 1913 the British Empire produced about half the output of tungsten ores. Since the commencement of the war the output of ore had risen to close upon 20,000 tons per annum, and the U.S.A. had become the largest producer, increasing its output from 1,400 tons in 1913 to about 7,000 tons in 1916, while the Empire production for 1916 was somewhat under 6,000 tons. He emphasised the necessity of keeping the British Empire sources of supply in the hands of British-born citizens. When war broke out there was only four months' supply in this country, but a factory was started, and one of the most serious problems with which munition makers were faced was solved. He believed the industry would be maintained in this country if it were given a fair chance.

Dr. E. E. Fournier d'Albe exhibited the optophone, invented by himself in 1914. This remarkable, but in manipulation simple, instrument is supplied by the Medical Supply Association, Gray's Inn Road, E.C.1, and it is the outcome of a series of researches on the half-metal selenium, carried out mainly at the University of Birmingham. The optophone was first shown to the Royal Society in 1914, and it is described as "the first radical solution of the problem of how to enable the blind to read ordinary print." A small disk is made to rotate rapidly by means of a minute electric motor. The disk is provided with five concentric circles of holes corresponding to musical notes. The disk is illuminated from below by a small electric lamp and condenser. A slit above the disk cuts out a radial portion, so that a line of five luminous dots is seen from above. A small image of this line is thrown upon the upper surface of a glass plate, and is thus focused upon any point laid flat upon the glass. The lamp, disk, and lenses are mounted on a carriage which can be moved from right to left by a handle. The top of this carriage bears a selenium tablet, which is placed in circuit with a battery and telephone. The glass plate with its stand forms a book-rest, which is moved to and fro at right angles to the printed line by means of a line-changing head. This head moves with audible clicks, and by counting these the operator can get the next line correctly into position. Practical proof was given by a blind student, Miss M. Jamieson, who, after only 90 hours' experience of the optophone, had attained a speed of 10 words per minute in reading. It was stated that with a little more practice she confidently hoped to raise the limit to 25.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Future of Coal Using.

I am interested in the article on p. 125 of your current issue by Mr. W. H. Booth, which is short, but very much to the point, regarding the use of coal in large generating stations, which have been so much to the front of late.

If there is one sure way of wasting coal it is to put down the big generating station with steam plant, such as has been suggested for London.

Such a proposition is a mad-brained suggestion of the large-unit schemer, who can see not much further than a big unit proposition of the steam type, with massive chimneys and plenty of waste gases, which he cannot see, but they are going into the atmosphere all the same.

Electricity can be generated as cheaply in half-a-dozen stations spread along the Thames at convenient points as at one central point, and such a scheme has far more to commend it than the central scheme.

Mr. Booth points out that: "Given a means of so arranging electrical supply that waste heat can be supplied to all households concerned within a limited radius, an enormous fuel economy would be secured."

What is the good or use of talking about grand schemes of electrical supply to save coal when the greater user of coal, namely, the householder, and the heating of houses are left out of the question? If generating stations are to be supplied on a large scale, then let the whole problem of generating electricity be combined with the greater one of saving coal in our households, by arranging a sensible scheme of domestic heating in connection therewith.

I very much wish Mr. Booth would give an article on such combination, as he is about the only authority in this country who is capable of dealing with the problem as it should be handled. I go further, and say that Mr. Booth is one of the engineers on practical economies who ought to be in the front giving advice to the Reconstruction Committee, and not in the background criticising the Committee's report.

Mr. Booth's article is valuable at this stage, but I hope he will deal with the matter exhaustively, so that it will command the attention of the Reconstruction Committee.

John I. Hall.

Kingston-on-Thames, *September 7th*, 1918.

Where are we Going To?

The somewhat pessimistic imagination of Mr. R. W. Paul has evidently left him brakeless, as his particular 'bus seems to have smashed up altogether. To his 'bus-like imagination it appears industry is going to the dogs; to the average trade unionist, it just appears he is on the fringe of something tangible and reasonable for his output in life.

The said output has been so long *solely* in the control of the limited liability system, but the spectacle of the trade unionist being in a position to tackle the aforesaid trusts, and play that part in industry which they are entitled to, seems to excite the direst foreboding on the part of Mr. R. W. Paul.

"A one-time member of this Union, who for several years watched the progress of our electrical pioneers towards, or through, the bankruptcy courts" evidently has some qualms concerning the E.T.U. controlling the industry. Well, the present writer had just as many in the past concerning Dick, Kerrs, Westinghouse, Cromptons, &c., &c., but a merciful providence in the shape of John Bull poured milk and honey into these concerns, with the result of their return to something like financial stability.

In this area the E.T.U. is endeavouring to use its best efforts for the apprentices, especially from the technical point of view, but with the employers' claim of sole control, and *their* idea of technical training, the effort to produce the right article "to flabbergast the Hun" is making slow progress.

Under the E.T.U. control, good jobs will be found for competent men; the "Are-you-in-the-know" and public school boy will get a back seat, and the fortunate individual receiving "three times the district rate for swanking around" will receive a period in "quod."

The past virility shown in this Empire has produced excellent results for one class only, and Mr. Paul will do well to understand that something apart from petty bureaucracy is in the field, and the pals of the electrical trade will have stronger stuff to sweep aside than bureaucrats.

"The directors of the British Empire" have, again, belonged to one class, and the hideous caste system (that old man of the sea on the workers' back), by which they have controlled trade, commerce, and mankind, has been an all-too-potent factor in our history, and "class consciousness" keenly describes the position.

The E.T.U. will welcome the "hundreds of businesses," and say let them all come, "honest enterprise," merit, respect, and esteem.

It seems to have been Mr. Paul's misfortune to have been governed by the truculence of the individual, and the combination to which he belongs. Oddly enough, the writer has had the same experience, only the truculent gentleman was the employer, the combination behind him the Contractors' Association, and the reward offered scanty enough to have starved Old Mother Hubbard. 'Nuff said; I am going to work!

J. W. Woolley,
Electrical Trades Union.

Whitley Bay, *September 9th*, 1918.

The Percentage Error.

Mr. A. T. Bullen's method of remedying one error by another inaccuracy is wrong. The meter in question is obviously 40 per cent. fast, and the correct method of dealing with the matter was a sum in simple proportion, *i.e.*, 140 : 40 : : 400 : 114, giving the allowance on the account as 114 units on the meter's registration of 400.

Gadgett.

London.

In dealing with the question of percentage error, the writer was moved solely by errors which *had* occurred through the exact meaning of the figure quoted by the test room being misunderstood.

While "Gadgett's" method is perfectly correct, it is not in universal use, nor will it ever be, because the majority of meter errors of the future will be within the region of 3 to 5 per cent., and the addition or subtraction of 3 per cent. makes very little difference whether it is based on the registered units or the correct units.

The mental method, therefore, will be the most used (*i.e.*, deducting 3 units for every 100 registered), as it has in the past, and it is for this reason that we should state the percentage error as so much per cent. of the units registered.

"Gadgett" calls it an inaccuracy, but it is not inaccurate to say that, of 400 units registered by my meter 28.5 per cent., or 114, were over-charged.

A. T. Bullen.

Eastleigh, *September 11th*, 1918.

Falk, Stadelmann & Co.

May I call your attention to a paragraph in *John Bull* of September 4th, 1918, *re* Messrs. Falk, Stadelmann & Co., which I think would be of much interest to electrical readers?

The Cable Makers' Association.
L. B. Atkinson, *Secretary.*

London, W.C., *September 10th*, 1918.

The following is the cutting referred to:—

HOW TO BECOME BRITISH.

A STUDY IN COMMERCIAL EVOLUTION.

Even in war-time it is quite an easy matter for a Germhun commercial undertaking to become as British as an East End whelk-stall. Observe how it is done. In the sweet, bygone days of peace Messrs. Falk, Stadelmann and Co., of London, Glasgow, and Manchester, manufacturers of the "Veritas" gas mantle and other lighting requisites, had names and addresses which would have been excellent passports to Potsdam. The Falks, the Thurnauers, and the Pappenheimers ruled the roast, and were unashamed of the fact that their places of residence were at Nurnberg, Hochberg, or elsewhere in the land of the Huns. Since then, however, all is changed. In the fifth year of war Messrs. Falk, Stadelmann & Co., Ltd., are "all-British," as that term is understood at Somerset House, the latest summary of Share Capital issued under official authority being a highly interesting document. Wonderful measures of "reconstruction" have been carried through. It is true that even now the trail of the Hun is not quite extinguished. The Chairman of the Company, Mr. Max Falk, though now a British subject, is compelled to acknowledge Wurtemberg as his "nationality of origin," while the other directors, Messrs. Victor Falk and Louis Thurnauer, coyly admit that it was in Wurtemberg and Bavaria respectively that their infant eyes first beheld the light.

Glancing at the Shareholders' List, we find that the Public Trustee has taken a hand, 49,367 Preference Shares held by Mr. Bernard Thurnauer, of Nurnberg, and afterwards vested in the Custodian of Enemy Property, having on May 1st, 1917, been restored to the Company, although for what consideration is not apparent. Much the same thing seems to have happened in the case of 1,000 Preference Shares once held by Mrs. Pauline Israel, of Hochberg. Upon the whole, it is clear that our obliging authorities have offered this Company every assistance in their efforts to clean up their shop front.

WAR ITEMS.

Non-Ferrous Metal Industry Act.—A further list of those to whom licences have been granted under this Act appears in the *London Gazette* for September 10th.

Munitions Tribunal Case.—We are informed that at the Edinburgh Munitions Tribunal J. G. Jones, jointer and overhead linesman, claimed back money under the 12½ per cent. award from October, 1917, to February, 1918, from the Musselburgh Tramways Co. The company held that Jones was not entitled to make such a claim as he had been away from their employment for over six months, and had not claimed earlier. The Tribunal granted the claim as there was no specified time in the award in which to make the claim.

To be Wound Up.—Under the Trading with the Enemy Acts the following company has been ordered to be wound

up:—Electro Osmose Syndicate, Ltd., Imperial House, Kingsway. Syndicate formed to purchase patent rights for the purification of clay. Controller: J. R. Tulloch, 4B, Frederick's Place, Old Jewry, E.C.2.

Trading With the Enemy.—The "London Gazette" for September 6th contains further additions to the lists of persons and bodies in the following countries with whom trading is prohibited:— Argentina; Bolivia; Brazil; Chile; Colombia; Cuba; Denmark; Ecuador; Greece; Guatemala; Hayti and Dominican Republics; Honduras; Mexico; Netherlands; Netherlands East Indies; Panama; Persia; Salvador; Spain; Sweden; Venezuela.

The Future of Russia.—Sir G. Buchanan, in a speech delivered in London last week, after stating that a peace which left Germany supreme in Russia and mistress of the East would be little short of suicide, said that we must respond to Russia's agonising cry for help. Colossal as was the task before us, we must assist her in the economic reconstruction that must precede the political reconstruction. We must be prepared to supply her, when the proper moment arrived, with expert advice, with capital, and with all the machinery necessary to restart her moribund industries, to render her agriculture more productive, and to revive her export trade, without which the depreciated currency could not recover.

Germany and After-War Trade.—Some of the German papers are devoting a good deal of attention to Allied preparations for improved export trade organisation after the war, and to British economic defence proposals and the prospect of their succeeding. In July, the *Vossische Zeitung*, recognising that all England favoured an economic war, but was not unanimous as to its duration and method, was urging those who advocated a "peace by understanding" to pay close attention to the subject. The suggestion was that advantage be taken of this difference of opinion, because nothing was more important for Germany's future than that such a war should be mitigated as far as possible, and its duration shortened. *Der Welthandel* in August was discussing some of the measures taken by France, America, and England during the war for the promotion of foreign trade. It is admitted that after four years of war Germany is faced with a great task in the foreign trade problem. One of its first necessities after the war will be to find out the real state of things in the world markets. For this purpose, capable commercial experts must be sent to investigate the changes in trade caused by the war; the German Commercial Expert Institute must be brought up to date; the consular service must be reorganised—men of practical commercial experience must occupy such posts; the Information Service must be expanded, and it must be under Government control; and so on. Something has been done by way of propaganda—through films and otherwise, and quantities of literature has been sent abroad to bring home to the foreigner "the prosperity of German economic methods," but the writer regrets that "there is no widely circulated German organ in foreign countries, and expresses the desirability that some of the existing papers should be translated and put on the foreign markets. He advocates the organisation of sample fairs and the establishing of large stores in the Balkans or the Near East, like the Americans did in Turkey. There is more of the same kind of thing, all of which ends with what reads like an appeal for the German Government departments to strengthen and develop foreign trade organisations, as schemes for expanding these organisations are expected to prove effective weapons in the coming economic struggle. By a stroke of the sword the Prussian War Lords cut off their foreign trade in August, 1914. Doubtless if the Prussians even thought seriously about their Empire trade interests at all they expected that after a short war, and a speedy crushing of their unprepared foes, they would quickly recover from the temporary stoppage of exports, and would swing along with an appropriate goose-step on to fuller commercial world domination. But the German commercial god or idol, like their military one, has had a great fall, like "Humpty Dumpty," and not all the economic writers in Germany, nor all the Hindenburgs and Ludendorffs, will easily be able to put its broken parts together again. But there will be a great effort to do so—that has always been obvious enough.

Exemption Applications.—At Oswestry, exemption until January 1st was conceded to W. H. Farrar (39, grade 2), electrician.

At Rochdale, in the case of two employés of the Rochdale Municipal Tramways, ordered by the Tribunal to join up, it was stated that all tramway appeals were to be adjourned pending consideration of the staff as a whole, and the decision in the two cases was cancelled. In the case of a tramway employé at Halifax, the appeal was adjourned for three months to await instructions.

Hereford Tribunal has granted exemption until January 15th to A. J. Rowberry (34, grade 1), electrical engineer.

At Aberystwyth, exemption was sought for H. Humphreys (41, grade 2), mains foreman with the Electric Light Co. It was claimed that he was in a certified occupation. With the assent of the National Service Representative, six months were conceded.

At Oxford, the Electric Tramways, Ltd., appealed for Victor Hill (36, grade 2), a skilled motor mechanic, and two months' temporary exemption was conceded.

BUSINESS NOTES.

Carbon Business in Argentina.—A concern called Le Carbone (late Lacombe et Cie) has been formed, with a capital of 2,800,000 fr., to manufacture and sell carbons and any products relating to the electrical industry. The company is to operate in the Argentine, and the representatives in Buenos Ayres are Messrs. Leon Pariand & J. L. Sidler.—*Review of the River Plate.*

Exports to China and Siam.—In the *Board of Trade Journal* for September 5th between six and seven pages are devoted to consolidated lists, revised to August 23rd, 1918, of persons and bodies in China and Siam to whom exports may be consigned.

A further list of persons and bodies in China to whom exports may be consigned appears in the *London Gazette* for Sept. 10th.

German Porcelain Industry.—According to the *Münchner Neueste Nachrichten*, disputes are proceeding in the German porcelain industry and trade with reference to the present high prices for porcelain products. The Association of East German Porcelain Factories, which has its headquarters at Altwasser, in Silesia, repudiates a suggestion that these prices are unduly high. Certain factories which, in virtue of army contracts, have enjoyed full employment and a full supply of coal, or which had large accumulated stocks at their disposal, have enjoyed temporary prosperity, and compensated themselves for the severe losses of previous years. For the factories without such special advantages—and these form the great majority—the prices fixed by the Association of German Porcelain Manufacturers do not counterbalance the increase of prices for raw materials, &c., and the restriction of producing capacity (through decrease of coal supplies) to one-fourth of the peace production. The conditions at present prevailing in the industry not only prohibit any reduction of prices, but urgently call for a further increase. The dealers desire to bring about a crisis in the Association of German Porcelain Manufacturers; but the manufacturers have every reason not to let this desire be realised.—*Board of Trade Journal.*

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. LVI, No. 276. July, 1918. Also Index to Vol. LVI. London: E. & F. N. Spon, Ltd. Price 7s.—This issue contains the following papers:—"Transient Phenomena in Electrical Supply Systems," by Prof. E. W. Marchant; "Mechanical Design and Specification of the Turbo-Alternator Rotor," by S. F. Barclay; "and the Discussion on "The Control of Large Amounts of Power."

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII, No. 8. August, 1918. New York: The Institute. Price $1.

"Works Lighting." By Daniel H. Ogley. 1918. Pp. 134, figs. 66. London: Iliffe & Sons, Ltd. Price 7s. 6d. net.

"Magnetism and Electricity for Home Study." By H. E. Penrose. Pp. 515, figs. 224. London: Wireless Press, Ltd. Price 5s. net.

Liquidations. — Anglo-Colonial Engineering Co., Ltd.—Meeting, October 11th, at Balfour House, Finsbury Pavement, E.C., to hear an account of the winding up from the liquidator, Mr. G. E. Corfield.

Rotherham Electrical Engineering Co., Ltd., Rotherham.—September 23rd is the last day for receipt of proofs for dividend by the liquidator, Mr. J. C. Clegg, Figtree Lane, Sheffield.

Steel's Electric and Engineering Co., Ltd., Poplar.—Liquidator (Mr. H. de V. Brougham) released September 3rd.

For Sale.—The stock, &c., of Messrs. H. M. Ashton, Ltd., electrical engineers, of Southampton (voluntary liquidation), are to be sold by auction.

Lantern Slides Wanted.—Mr. J. Glynn Williams, 4, Blaen Naut Street, Duffrynville, Cymmer, Port Talbot, will be glad to hear from any manufacturers willing to lend on hire films or lantern slides on matters dealing with their manufactures for lecture purposes during the coming winter.

Social Club.—The employés of Messrs. A. Kershaw and Son, Ltd., scientific instrument makers, and the Kershaw Optical Co., Ltd., Leeds, have formed a social club, to promote recreation and social intercourse amongst its members. Under its auspices a cricket match, in which both ladies and gentlemen took part, was played on Saturday last.

Catalogues.—British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C. 4. — Folder giving a short explanation of the Government Lighting Restrictions (Household Fuel and Lighting Order, 1918) as revised. Small quantities overprinted with contractors' names and addresses will be supplied free on application.

New Electric Heating Elements.—Recent improvements in the Schoop metallic spraying process include electric heating elements produced by this method. An American patent of M. W. Schoop describes a method of using this process. The metal is deposited in the form of a spiral on a rotating insulating tube by moving the holder of the squirting apparatus along the tube as it rotates. Guard plates are provided for preventing the spray from widening out.—*Electrical Review and Western Electrician.*

LIGHTING AND POWER NOTES.

Argentina.—Fuel Shortage.—To cope with the shortage of coal, the Government has supplied the German Transatlantic Electricity Co. with river vessels for the transportation of wood, and the company has purchased large quantities of maize for use as fuel. For the same purpose the Buenos Aires Gas Co. is considering the purchase of 4,000 tons of low-grade flour!

Australia.—Tasmania.—The absence of hydro-electric power is the chief cause of the delay in the progress of the electrolytic treatment of zinc-lead sulphides at the Mount Read and Rosebery Mines. The company requires a small amount of power in the first instance and a large amount a few years hence. The manager of the Tasmanian Hydro-Electric Department states that the Yolande River scheme had been investigated, and would yield about 5,000 h.p. The King River scheme would produce 45,000 h.p. continuously, and the lower auxiliary scheme on the King River would produce 15,000 h.p. He expresses the opinion that it will not be many years before all the power will be in use.

Balmain.—The Council has decided not to purchase the undertaking of the Electric Light and Power Supply Corporation.

Sydney.—The E.C. recommends that authority be sought for additional loans, to the extent of £500,000, for future operations in connection with the Council's electric lighting undertaking, the balance available against the £500,000 authorised to be raised by the State authorities being £31,415, for further capital outlay. In connection with the £500,000, upon which the Council has been working, although the State authorities have sanctioned the loans, no replies have been received from the Federal Treasury to the Council's application for sanction to borrow.

Victoria.—The Premier of Victoria states that the sources of electrical energy in the State are to be co-ordinated and controlled by one body, consisting of technical and business men. It is not intended to allow private enterprise to exploit the brown coal deposits, but the Government is open to consider proposals from those interested regarding water-power schemes.

Kiewa Hydro-Electric Scheme.—The Minister of Water Supply has announced that it has been decided to allow a private enterprise to utilise the water power of the Kiewa River. The lease is to be for 15 years, or, under certain conditions, for 50 years. The company is to produce a bank guarantee of £30,000, to agree to terms as to the price to be charged for energy, and to supply energy to the north-eastern centres before going further afield.

Melbourne.—A deputation of the Electrical Traders' and Contractors' Association has protested to the Minister of Public Works against the proposals of the City Council to install electricity in small houses on the hire system, on the ground that the scheme would not be run on commercial lines, and that apparatus would ultimately be sold at cost price, or less, to increase the sales of energy, to the detriment of electrical contractors. The Minister agreed to consider the matter again.

Birkenhead.—Price Increase.—The following is the scale of charges to be put into force by the T.C. on October 1st, showing the increase over pre-war rates in parentheses:—Within the borough, lighting, flat rate, 6d. per unit (50 per cent.); maximum demand, 8d., 4d., and 2d. (33 per cent.); prepayment meters, 6¼d. (39 per cent.); power, up to 1,500 units per quarter, 2¼d. (50 per cent.); above 1,500, 1½d. (50 per cent.); heating and cooking up to 1,500, 1¾d. (16⅔ per cent.); above 1,500, 1½d. (50 per cent.). Outside the borough, prepayment meters, 7¼d. (45 per cent.); power, 2¾d. (37½ per cent.); heating and cooking, 2½d. (25 per cent.). All special consumers will be charged an extra 7½ per cent., making a total advance of 40 per cent.

Birmingham.—Wages.—The semi-skilled and unskilled employés of the Corporation have applied to the Committee on Production for the extension to them of the award of 3s. 6d. per week recently granted to the engineering trades. If granted, it will increase the Corporation's wages bill by £70,000 per annum.

Burnley.—Sale of Plant.—The Bury Electrical Plant Co. has been informed that the Corporation is not prepared to give an option to purchase certain obsolete plant at the electricity works, but is willing to sell the plant outright for £725, provided that a deposit of £250 be made immediately.

Calder Valley (Yorks).—Strike.—The strike notices of the employés of the municipal authorities of the Calder Valley have been withdrawn, and the dispute referred to the Ministry of Labour.

Canada.—Water Power.—In connection with the application of the Aluminium Co., of America, for permission to construct a dam on the St. Lawrence River for hydro-electric purposes, the Minister of the Interior and the Minister of Customs are visiting Washington to confer with the United States Government with a view to the joint development of power at Longsault Rapids.—*The Times.*

Carrickmacross.—Public Lighting.—The Lighting Co., at the request of the U.D.C., has reduced its tender for electric lighting from 10d. per unit to 9d., and the Council has decided to postpone the lighting of the street lamps for a month.

Continental.—Italy.—An increase of capital from 15,000,000 lire to 32,000,000 lire is under consideration by the Società Elettrica della Sicilia Orientale in order to carry out its large programme in the interior of Sicily. Its name is also likely to be changed to Società Generale Elettrica della Sicilia.

There has been formed at Milan the Società Idroelettrica dell'Ozola, with a capital of 1,000,000 lire, for the purpose of constructing hydro-electric plants in the province of Reggio Emilia.

With a capital of 5,000 lire, there has been established at Verzuolo the Società Idroelettrica Monviso-Verzuolo, for the construction of hydro-electric installations.

The amalgamation of the Società Astese di Elettricità with the Società Chierese di Elettricità, with currency from April 30th, 1918, is announced.

Dewsbury.—Price Increase.—The Electricity Committee has recommended that the advanced charges for electricity recently decided upon be deferred until January 1st next.

Dublin.—E.L. Restrictions.—The Electricity Committee has postponed further consideration of the question of reduced supply for industrial and lighting purposes pending a report on the subject from the Dublin Industrial Development Association.

Dudley.—Price Increase.—The Electricity Committee has recommended the T.C. to agree to the increase of 12½ per cent. (making 37½ per cent. over pre-war prices) in the price of electricity supplied within the borough by the Shropshire, Worcestershire and Staffordshire E.P. Co.

Eastbourne.—Year's Working.—In his annual report for the year ended March 31st, 1918, the borough electrical engineer states that during the year ten electric welding machines for the motor-'bus department were added to the load, and 68 street lamps were converted from gas to electricity; 102 arc lamps and 141 incandescent lamps are installed for street lighting, although, owing to the war, these are not all in use. The number of consumers increased by 106, to 2,934. The load factor was 19·77, compared with 18·45 in the preceding year, and the maximum load was 1,415 kw., against 1,202. The income for the year amounted to £39,221, against £31,213, and the expenditure was £20,862, against £16,768. Capital charges absorbed £13,586, leaving a net profit of £4,773, against £843. The renewals fund stands at £10,422. Units sold totalled 2,450,473, against 1,944,528, and included lighting 1,218,208, against 1,077,583; power 583,530, against 400,389; heating 573,395, against 415,234; cooking 61,609, against 46,987; and public lighting 13,731, against 4,335. The works cost per unit was 1·29d., against 1·24d., the total cost, excluding capital charges, being 1·94d., against 1·96d. The average revenue per unit was 3·83d., against 3·85d.

Keighley.—Price Increase.—The Electricity Committee has recommended the Corporation to increase the charges for electricity for lighting by 1d. per unit, and for power, to consumers not under sealed agreement, by ½d. per unit, commencing October 1st next.

Larne (Co. Antrim).—Public Lighting.—The Council has accepted the tender of the E.L. Co. for public lighting for three years at £761 per annum, less £40 during war restrictions, with an option to end the contract at the end of the first year on payment of £830, less £40. This is an increase of 40 per cent. on the pre-war charge.

London.—Hackney.—Wages.—The B.C. has complied with the award of the Committee on Production, increasing the war bonus to technical staff and employés at present receiving a bonus of £1, plus 12½ per cent., by a further 3s. 6d. per week.

Luton.—Loan Sanction.—The Corporation has received L.G.B. sanction to a loan for the purpose of electricity extensions; the loan is repayable within 30 years, at 5 per cent. interest on the outstanding balances.

Shropshire, Staffordshire and Worcestershire E.P. Bill.—The cost of the petition against this Bill amounted to £1,335, and is to be paid by the local authorities concerned on a rateable value basis.

Stretford.—Proposed Loan.—The Electricity Committee is to apply to the L.G.B. for permission to borrow £26,100 for the erection of a sub-station and the provision of cable and plant, in connection with a supplementary supply of electricity.

Swansea.—Year's Working.—The annual accounts of the Corporation Electricity Department for the year ending March 31st last show that the income increased by £3,306 and the working expenses by £3,881; capital charges increased by £551. The net profit was £3,255, compared with £4,412 in the previous year. The chairman stated that it was a matter for congratulation that they had been able to maintain their position without increasing the cost of energy during the year, and also to make a profit. In the current year the prices had been increased by 12½ per cent., but that was already covered by workmen's bonuses and the extra cost of coal. This is the first increase in charges at Swansea since the commencement of the war. Services, costing £14,000, were met out of reserve, as loans could not be obtained. Sinking funds, reserve fund, and capital expenditure out of revenue and reserve totalled over £100,000, which was 38 per cent. of the capital.

National Electricity Supply.—In view of the Government proposals for the linking-up of electricity undertakings, and the possibility of the Corporation taking over a larger area, the chairman and vice-chairman of the E.L. Committee and the

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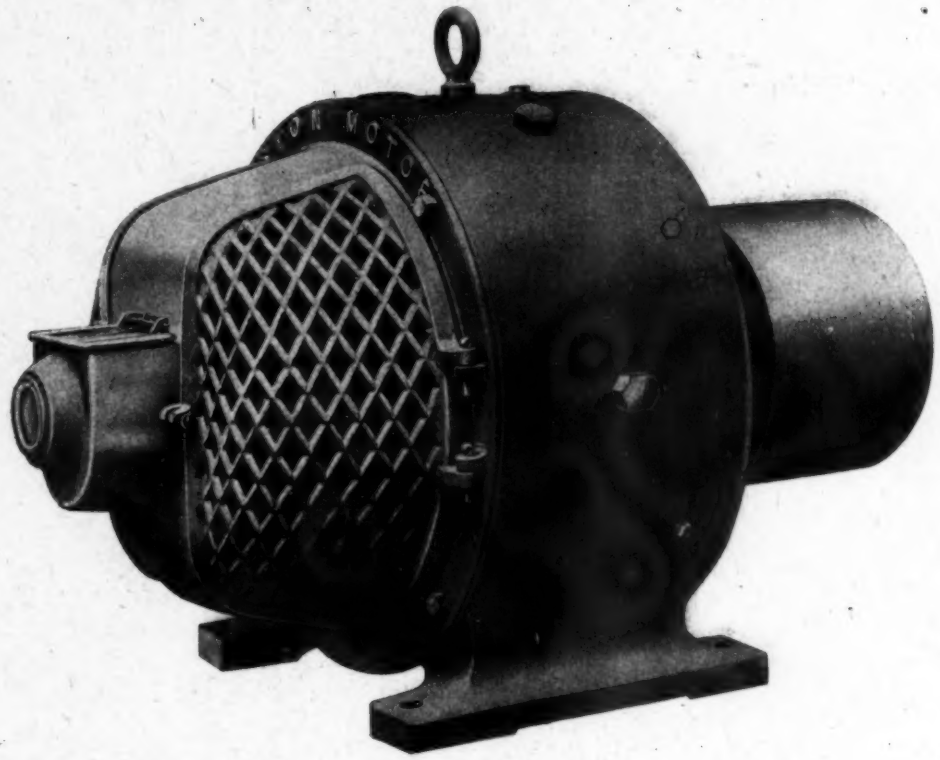

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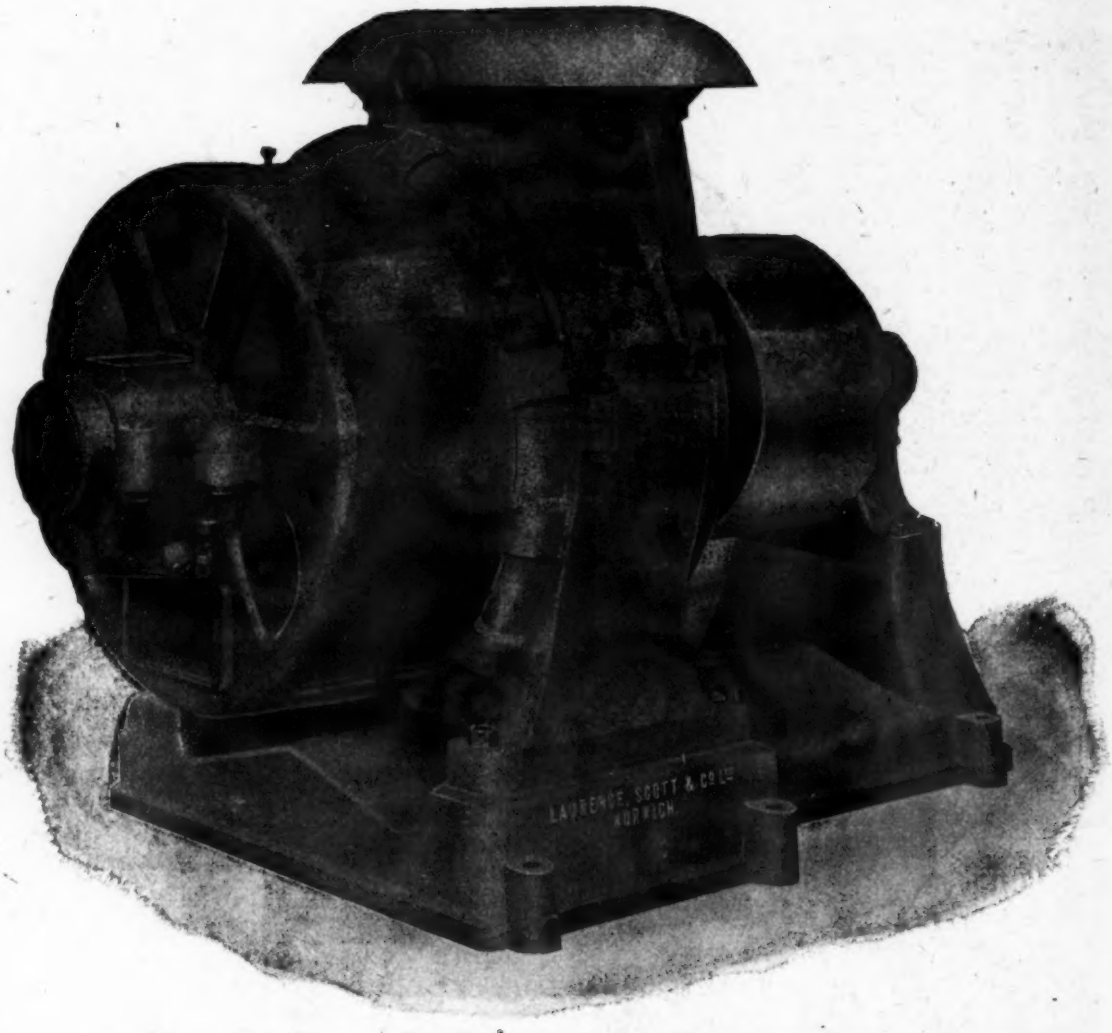

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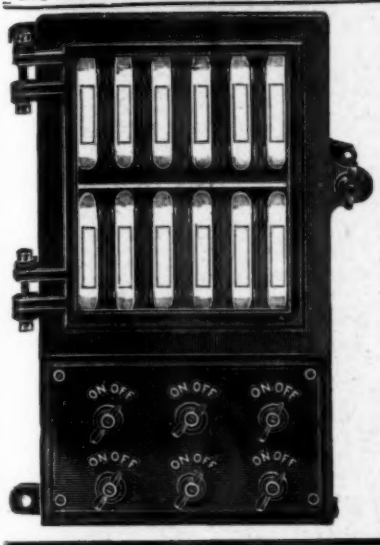

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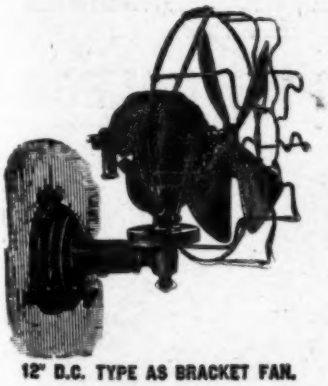

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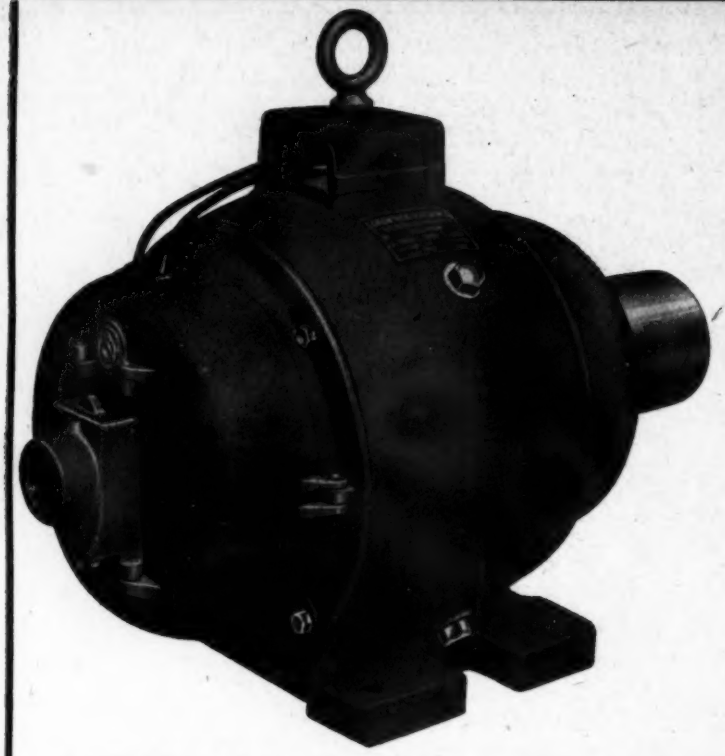

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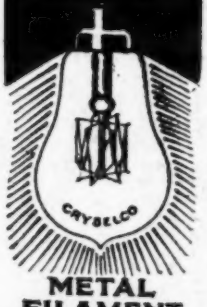

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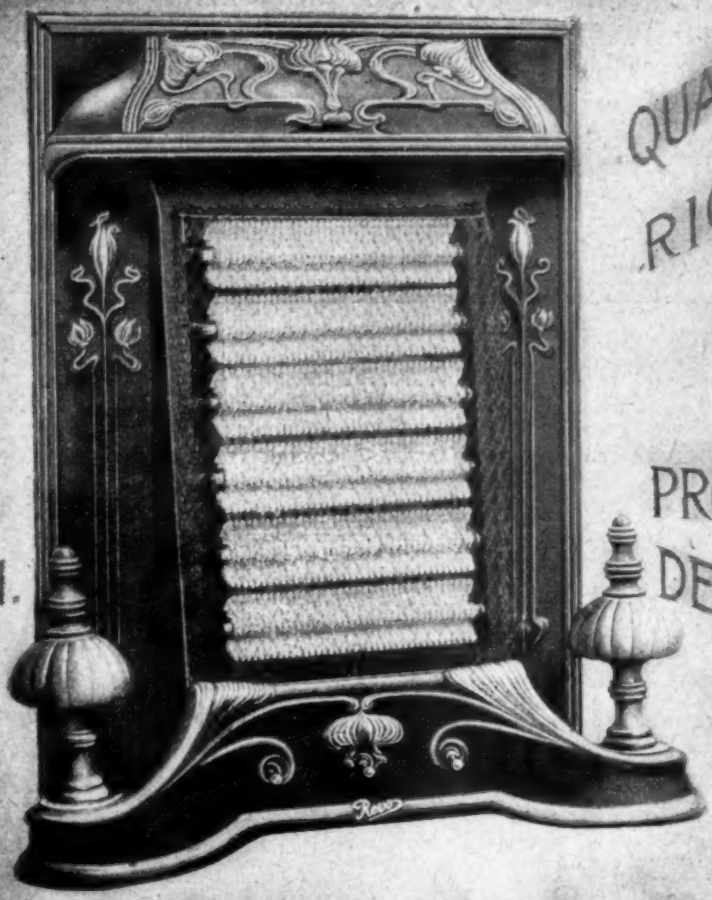

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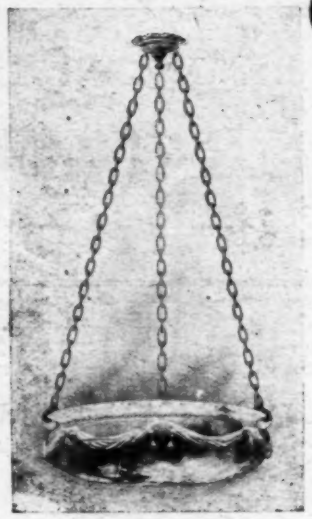

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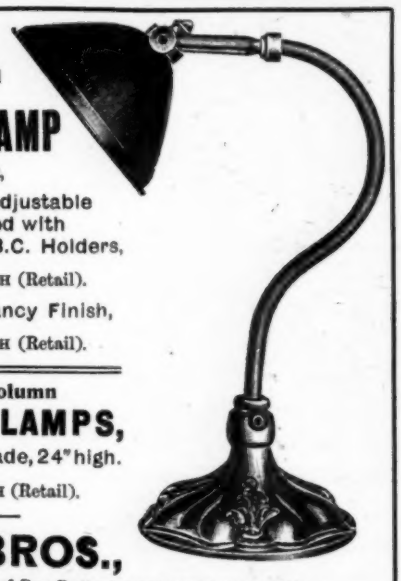

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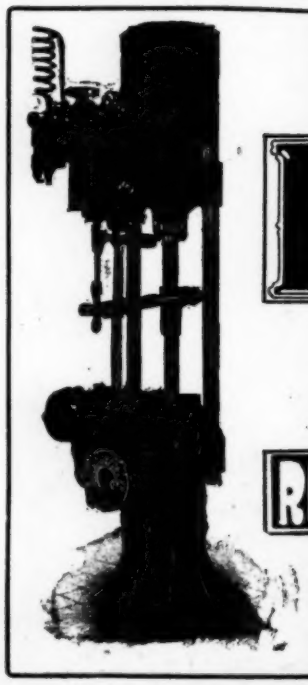

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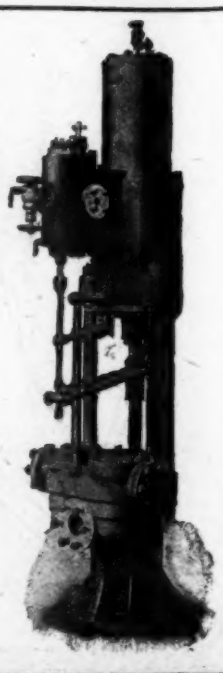

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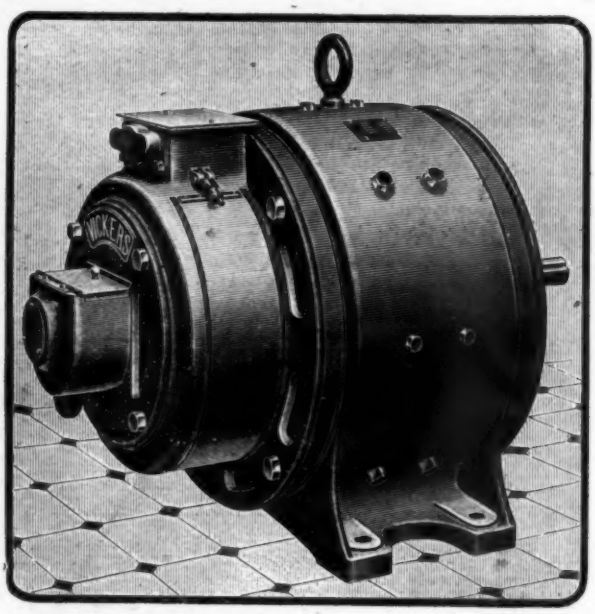

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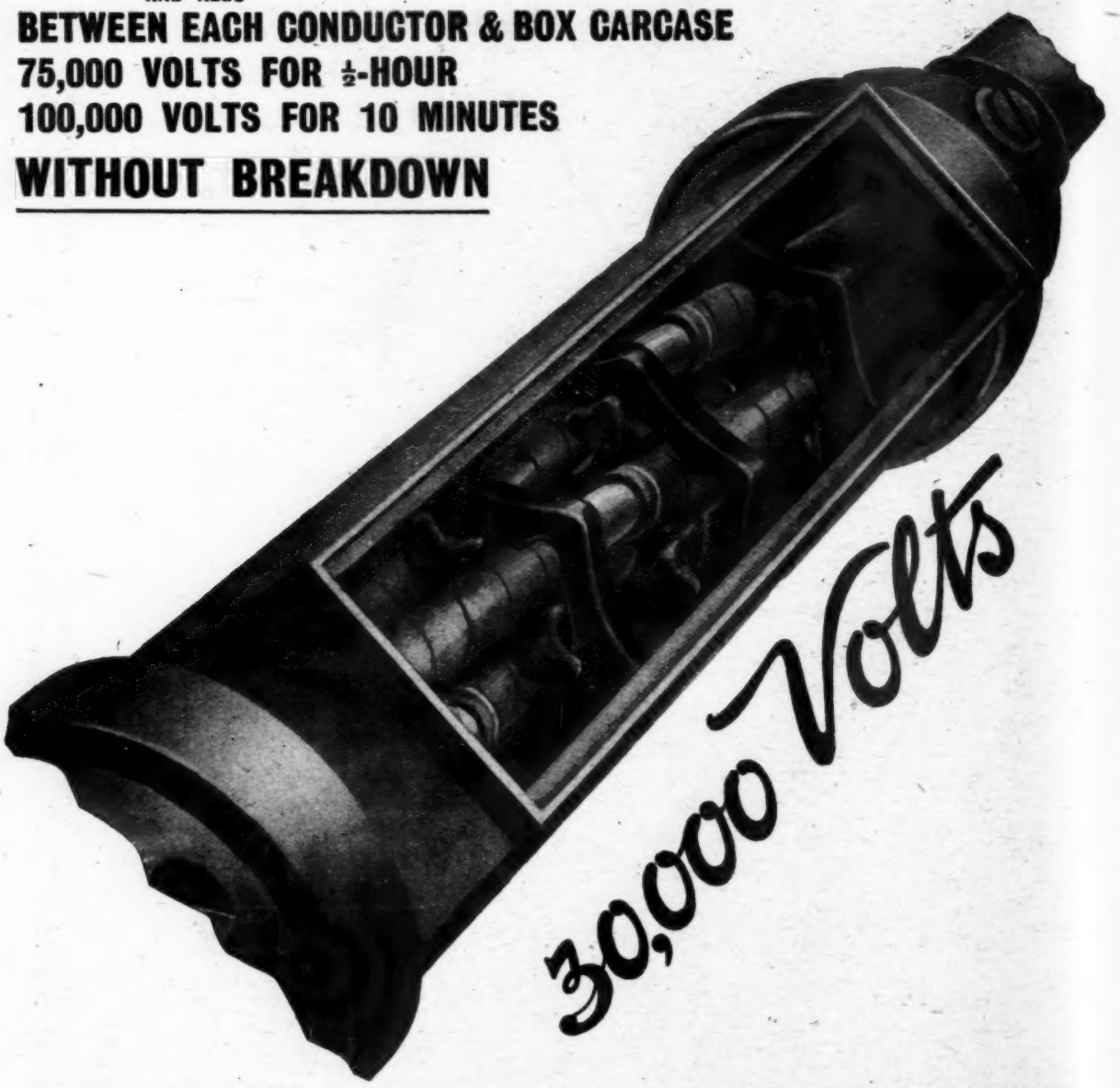

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Applications, stating age, qualifications, and salary, to be forwarded to the BOROUGH ELECTRICAL ENGINEER, Frederick Road, Salford, not later than MONDAY, SEPTEMBER 16th, 1918.

L. C. EVANS,
Town Clerk. 2486

RESIDENT ENGINEER FOR INDIA.

REQUIRED RESIDENT ENGINEER to take charge Generating Station, three-wire, direct current, with battery, Hornsby heavy oil engines and steam plant, Babcock boilers, overhead mains. Salary 550 rupees per month.

Applicants must state age and experience of responsible positions in generating stations, and must have obtained medical certificate of fitness for India, and (if liable for military service) consent of Ministry of Munitions and of Ministry of National Service for issue of passport. Apply, by letter only, to—

HANCOCK, DYKES & TROTTER,
11, Victoria Street, Westminster, S.W. 1. 2537

SWITCHBOARD ATTENDANT.

WANTED, a Switchboard Attendant. Applicants must have had a good electrical training and experience in running L.T. three-wire D.C. and three-phase rotary plant, and preferably with mechanical knowledge. Wages, including bonuses, to commence at £3 3s. per week of 48 hours.

Applications, stating age, qualifications, and when able to take up duties, together with copies of recent testimonials, to be sent immediately to the CHIEF ENGINEER, Electricity Works, Lombard Road, Battersea, S.W. 11.

W. MARCUS WILKINS, *Town Clerk.* 2566

ELECTRIC LIGHTING ATTENDANTS.

REQUIRED ATTENDANTS for Camp Hutment Electric Lighting Installation. Applicants should have experience in the running and maintenance of high-speed Petrol-paraffin Engines and direct-current Generating Plant, wiring, &c. Capacity of Generating Plant 35 KW.

Applications, stating age, experience and wages required, with copies of testimonials, should be forwarded to—

D.O.E.L.,
Electric Light Station,
Curragh Camp, Ireland. 2525

JOINTER-WIREMAN.

REQUIRED at once, Jointer-Wireman with experience in making joints on 3-core paper-insulated, lead-covered and armoured cables, and be able to plumb joints, also experience in wiring (conduit and cleat systems).

Apply, stating age, experience, wages required and when able to commence duties, to—

D. O. E. L.,
Electric Light Station,
Curragh Camp,
Ireland. 2558

CHARGE ENGINEERS.

WANTED, qualified Charge Engineers, experienced in H.T. A.C. operation. Commencing salary, £182 per annum inclusive. Permanency for experienced men.

2554, ELECTRICAL REVIEW, 4, Ludgate Hill, E.C. 4.

ENGINEER.

ENGINEER, with experience of both A.C. and D.C. Plant, wanted to take charge of shift in certified Electricity Works South of England.

Commencing wage 40s., plus 20s., plus 12½ per cent.

2550, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

SITUATIONS VACANT.—*Continued.*

COUNTY BOROUGH OF NEWPORT.

Electricity and Tramways Department.

APPLICATIONS are invited for the position of second Technical Assistant. Candidates must have had a thorough training and experience as mechanical and electrical engineers, and occupied responsible positions in an Electricity Supply Undertaking, and have been accustomed to the supervision of constructional works. Applicants with a knowledge and experience of tramcar maintenance and reconstruction preferred.

Commencing salary £250 per annum, inclusive of all bonus to date.

All applications must be made on the official form provided for the purpose, which, together with a list of duties and terms of engagement, may be obtained on application to the undersigned, and must be returned not later than MONDAY, SEPTEMBER, 23rd, 1918.

(Signed) A. NICHOLS MOORE.
Borough Electrical and Tramways Engineer.

Town Hall, Newport, Mon.
September 10th, 1918. 2548

SHIFT ENGINEER.

CORPORATION ELECTRICITY WORKS in Lancashire (certified undertaking) require services of Shift Engineer.

Commencing wage, including all bonuses, £3 7s. 6d. to £3 15s. per week, according to experience.

Applications stating age, married or single, qualifications and salary required, together with two recent testimonials, to be delivered to 2551, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

COUNTY BOROUGH OF CROYDON.

Assistant Mains Superintendent.

AN ENERGETIC ENGINEER required as above; a thorough knowledge of high and low-tension distribution essential; salary £3 per week, plus 20s. and 12½% bonus.—Write, giving full particulars, to MANAGER, Electricity Works, Factory Lane, Croydon. 2560

SHIFT ENGINEER.

SHIFT ENGINEER wanted for 1500-KW. combined A.C. and D.C. station (Certified Undertaking). Must be fully qualified man with mechanical and electrical experience.

Applications, stating age, experience, salary required, and when able to commence, accompanied by copies of recent testimonials, to be addressed to—

2568, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

SWITCHBOARD ATTENDANT.

SWITCHBOARD ATTENDANT Wanted. Must be accustomed to combined Alternating-current and Direct-current Station. Ineligible for the services. Total inclusive wage £2 11s. 10d. per week, 8-hour shifts.

Apply, giving copies of testimonials, to—

BOROUGH ELECTRICAL ENGINEER,
Electricity Works, Southampton. 2521

FITTER AND TURNER, STOKER, &c.

FITTER and Turner required. Good all-round man having knowledge of general engineering repairs and upkeep of boilers, engines, steam and hot-water heating. Apply by letter, stating wages required, enclosing copies of references, &c., to ENGINEER, No. 4, Canadian General Hospital, near Basingstoke.

Also Stoker and Handyman.—Apply as above. 2572

SHIFT ENGINEER AND SWITCHBOARD ATTENDANT.

SHIFT ENGINEER wanted for Certified Undertaking, 3-phase and D.C. experience. Salary £170 plus 12½%. Also a Switchboard Attendant with similar experience, wages £2 5s. plus 12½%.

Apply, stating age and qualifications, to—

TWICKENHAM AND TEDDINGTON ELECTRIC SUPPLY CO.,
York Street, Twickenham. 2526

CABLE JOINTER.

WANTED immediately, Cable Jointer accustomed to work on paper insulated cables, do own plumbing. Applicants must be ineligible for service with H.M. Forces.—Apply with references, giving particulars of previous experience and stating wages required, to BOROUGH ELECTRICAL ENGINEER, Electricity Works, Gillingham Road, Gillingham, Kent. 2553

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

ARMATURE Winder for A.C. and D.C. repairs. No person resident more than 10 miles away, or already on Government work, will be engaged.—THE MAGIC APPLIANCES, LTD., 187, Hercules Road, Lambeth. 5528

ARMATURE Winder wanted for repair work in East London. No one residing more than 10 miles distant, or at present on Government work, need apply.—5403, ELECTRICAL REVIEW, 4, Ludgate Hill, London

ARMATURE Winder wanted for repair work in East London No one residing more than 10 miles distant, or at present on Government work, need apply.—5549, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARMATURE Winders, used to D.C. and A.C. repairs and rewinds, also switchboard and controller hands. No person already employed on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5944. 2457

ARMATURE Winders, used to repair shop, D.C. work. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply H. D. & S., 32, Newington Causeway, S.E. 1686

ASSISTANCE Buyer required with experience in raw materials for electrical manufacturing; organising ability essential. No person on Government work will be engaged.—State age and wages required to 5535, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Engineer wanted for Direct-current Generating Station with Steam and Diesel Oil Engines. Salary £263 per annum, including bonuses.—Apply, stating full particulars of experience and qualifications, to CHIEF ENGINEER, Chelsea Electricity Supply Co., Ltd., 19, Cadogan Gardens, London, S.W. 3. 2580

ASSISTANT Engineer wanted for small undertaking; capable of executing repairs on consumers' premises and mains work. Knowledge of Diesel engines preferred. Salary £150. Must be low category.—2470, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Estimating Engineer required immediately for control gear sales department, electric engineering work. South Coast.—Apply, stating age, qualifications, and salary required, to 2399, ELECTRICAL REVIEW, 4, Ludgate Hill. London.

ASSISTANT Storekeeper required, permanent position for discharged or ineligible man; also youth for trade counter. No persons already employed on Government work, or living over 10 miles from Charing Cross, need apply.—Apply in writing, or call any morning at 10 o'clock, SIMPLEX CONDUITS, LIMITED, 113/117, Charing Cross Road. W.C. 2. 2567

CAPABLE Test Room Assistant wanted. Experience with contactor gear an advantage but not essential, good prospects if suitable. No person already on Government work will be engaged. —Apply, giving full particulars of experience and wages required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5824. 2265

CAR Shed Fitter with knowledge of fitting and turning required. Preference given to man with knowledge of magnetic brakes. —Reply, stating qualifications and wages required not later than September 21st, to F. NEWEY, Acting Borough Electrical Engineer, Electrical Works, Swindon. 2528

CHARGE Engineer required for the Company's power station in Barnsley district. Experience with E.H.T. 3-phase working turbo-generators and water-tube boilers essential. Certified undertaking.—Apply with full particulars and stating salary required to "GENERATION," The Yorkshire Electric Power Company, Dewsbury. 2536

CHARGE Engineer wanted for D.C. station, gas and steam, £166 per year, plus 12½ per cent. war bonus.—Experience and testimonials to BOROUGH ELECTRICAL ENGINEER, Weymouth. 5532

CHIEF of Test Room wanted, with first-class experience in calibration, and testing of moving coil and moving iron instruments; must be energetic, capable of getting work through quickly, and able to train female labour. No person already on Government work will be engaged.—State age, qualifications, experience and salary expected, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5595. 2487

CHIEF Tester required, to take charge of transformer test, by large electrical firm in the Midlands. Permanency to suitable man. No person already on Government work will be engaged.—Apply, stating age, experience, salary required, and quoting No. A6003, to your nearest EMPLOYMENT EXCHANGE. 2534

DESIGN Department, North of England firm, requires Assistant with knowledge of either D.C. or A.C. machine design. Applicant must be over 25 years of age and preferably of low category. No person already employed on Government work will be engaged. —Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5950. 2465

DISTRICT Engineer required, experienced in O.H. line work, and with good knowledge of plant on consumers' premises, &c.—Apply, stating all particulars and wage required, to SCOTTISH CENTRAL ELECTRIC POWER CO., 1, Kirk Wynd, Falkirk. 2472

SITUATIONS VACANT.—*Continued.*

DRAUGHTSMAN, several good mechanical, wanted for design of steam turbines, electrical machines, and control gear, by large firm in the Midlands. No person already on Government work will be engaged.—Apply, stating qualifications, age, salary required, and earliest date can commence, to your nearest EMPLOYMENT EXCHANGE, mentioning this paper, and No. A5996. 2529

DRAUGHTSMEN for transformer work, required by large electrical firm in the Midlands. Previous experience not essential. Permanency to suitable men. No person on Government work will be engaged.—Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, quoting No. A6005. 2533

DRAUGHTSMEN, with experience in electrical instrument work, are required for London military establishment.—5517, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRIC Vehicle Garage and Battery Depôt (London).—An Electrician with an all-round experience, including accumulators and machines (D.C. and A.C.), is required as Working Foreman; rate 1s. 3d. per hour, plus 3s. war bonus, plus 12½ per cent. No person resident more than 10 miles away, or already employed on Government work, will be engaged.—2383, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Fitter wanted used to central-station switchgear and repair work; standard rate of wages.—Apply, with full particulars of experience, stating age, and enclose copies of testimonials, to NORTHAMPTON ELECTRIC LIGHT & POWER CO., LTD. 2423

ELECTRICIAN wanted for C.A.V. 'bus lighting on a fleet of motor 'buses in the provinces; 60 hours, 1s. 3d. per hour.—2569, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIANS required for maintenance and war work.—Apply THE HENDON ELECTRIC SUPPLY CO., LTD., 43, Golders Green Road, N.W. 4. 2571

ENGINE Driver for D.C. station (certified undertaking), steam and Diesel engines. Wages (with bonus) £2 18s. 6d. for 56-hour week.—Applications stating experience, &c., to ENGINEER, Electricity Supply Co., 93, High Road, Chiswick, W. 4. 2555

EXPERIENCED Foreman or Forewoman required to take charge of flashing and mounting department, carbon filaments. No person resident more than 10 miles away, or already on Government work, will be engaged.—9728, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FIRST-class Wireman for lighting and power. Permanency for good workman, must be used to country house plants. Discharged soldier not objected to. No person already employed on Government work will be engaged.—Apply, stating experience and wages, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5988. 5515

FITTERS, with electrical experience, and Turner for railway repair shop near Willesden; ineligible; permanency; 73s. including bonus, 54 hours. State age and experience.—2517, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

IMPROVER wanted for 3-wire D.C. Corporation electrical works. —Apply in first instance, stating age, experience and salary required, together with copies of testimonials, to 2448, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

LINESMAN, for E.H.T. overhead work, permanent job.—Apply, stating age, experience, wages, &c., to 2473, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MAINS Jointer for three-wire D.C. system, good knowledge of motors and wiring.—Age, experience, and wages required per week of 53 hours, also time required to take up duties, to the ELECTRICITY SUPPLY CO., LTD., Guildford. 2575

QUALIFIED Meter Testers required. No person on Government work, or living more than 10 miles away, engaged.—Apply, stating age, experience and wages required, to THE ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, London, S.W. 8. 5394

SHIFT Engineer required for three-wire D.C. and H.T. A.C. certified establishment; wages including all bonuses 62s. per week.—Apply stating age and experience, 2451, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer wanted for Hydraulic Power Station in North Wales. Must be experienced in large D.C. Generators, A.C. and Transformer Plant. No person already employed on Government work will be engaged.—Apply, stating salary expected, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5902. 2573

SHIFT Engineer wanted for power station.—Apply, stating age and experience, to LANARKSHIRE TRAMWAYS CO., Motherwell. 2520

SHORTHAND Typist required for wholesale electrical house and to superintend small office staff. Good salary to experienced person. No person resident more than 10 miles away, or already on Government work, will be engaged.—Write, giving full particulars, 5530, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

STOREKEEPER wanted. No person resident more than 10 miles away, or already on Government work, will be engaged.—Reply, stating age, experience and wages required, J. H. TUCKER AND CO., 217, Shaftesbury Avenue, W.C. 2. 5529

STORES and Material Clerk, wanted for electrical engineers and contractors. Smart intelligent man only. Discharged soldier would have preference. State if any previous experience, references, and wages required. No person already employed on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5917. 2484

SWITCHBOARD and Sub-station Attendant wanted for A.C. and D.C. station in West of England (Government Establishment). Good wages plus war bonus per week of seven 8-hour shifts, plus 12½%. Sunday, time and half. No person already on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, giving full particulars of training and experience, and stating military category, and mentioning No. A6013. 2531

SWITCHBOARD Attendant for power station near London. Experienced with D.C. 3-wire plant and batteries.—State union rate of wages required, age, theoretical and mechanical training, military category, with copies of testimonials, to 5419, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant wanted for Central Station.—State age, wages required and full particulars of training, &c., and enclosing copies of testimonials, to 2447, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TEST-Room Assistants wanted conversant with motor control gear. No person on Government work or living more than 10 miles away engaged.—Apply, stating age, experience and wages required, to THE ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, London, S.W. 8. 5500

TESTER required for electrical switchgear works. No person already employed on Government work will be engaged.—Reply, stating particulars of experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5938. 2489

TESTERS for transformer work required by large electrical firm in the Midlands. Permanency to suitable men. No person on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, stating age, experience, salary required, and quoting No. A6002. 2535

THE Directors of a large Engineering Firm in the West Riding of Yorkshire are open to appoint a Gentleman with high-class engineering and business experience to occupy the post of Commercial Manager, such position to carry a seat on the Directorate of the Company.—Applications will be treated in confidence and should be addressed to 5459, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, a Wireman for electric lighting and telephones; wages 55s. per week.—Apply to the MEDICAL SUPERINTENDENT, Parkside Asylum, Macclesfield. 2538

WANTED, Assistant to Sales Manager, must be energetic, with good knowledge of electrical trade (accumulators, wires and cables, &c.), publicity and sales organisation. No person resident more than 10 miles away, or already on Government work, will be engaged.—Write, stating age, experience, and salary required, to FULLERS, Woodland Works, Chadwell Heath, Essex. 2579

WANTED at once for London station, Fitter with turbine and general station experience. Standard rates of pay.—2436, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by a firm in the S.E. district engaged on munition work, first-class Telegraph Mechanics. No person resident more than 10 miles away, or already engaged on Government work, will be engaged.—State age and experience to 6125, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by leading engineering insurance company, Electrical Surveyors, having good knowledge of the theory and practice of alternating and direct current plant. Applicants must be ineligible for the Army or Navy.—2581, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by Mann, Egerton & Co., Ltd., 177, Cleveland Street, W. 1, for urgent Government work, 50 Electricians, used to screwed tubing work, lighting, or power. Good wages given. Fares paid to and from the job. No person resident more than 10 miles away, or already on Government work, will be engaged.—Applications, stating age and qualifications, to the above address. 2552

WANTED, Driver at small country supply station; gas and oil engines; wages 50s per week, plus 12½ per cent.—Apply, with references, to ENGINEER, Electricity Works, Ascot, Berks. 5541

WANTED, Engineer-in-Charge of a small D.C., 3-wire station of 850 KW. capacity; gas and oil plant; would be required to assume complete control under engineer and manager; salary £220 per annum.—Applications, with references, to ENGINEER AND MANAGER, Electricity Works, Ascot, Berks. 5540

WANTED, experienced Diesel Engine Drivers; also Shift Engineers, with knowledge of A.C. and D.C. station work; men willing to train for above should also apply.—ELECTRICITY WORKS, Leatherhead. 5383

SITUATIONS VACANT.—*Continued.*

WANTED, General Assistant to Works Manager in an old-established electric lamp factory. Good opening and progressive salary. No person already on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning No. A5667. 2037

WANTED on a Scottish Power Company (Certified Undertaking), a Shift Engineer with good mechanical and electrical training. Good wages to a man thoroughly experienced in E.H.T. 3-phase work and boiler house control.—Reply giving full particulars, with copies of references, to 1975, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Order Clerk for electrical trade, one with export experience preferred. Must be energetic, quick, and accurate worker. No person resident more than 10 miles away, or already on Government work, will be engaged.—Write, stating age, experience, and salary required, to F.G., Fuller's, Woodland Works, Chadwell Heath, Essex. 2578

WANTED, Ordering and Stores Clerk for electrical instrument makers. No person resident more than 10 miles away, or already on Government work, will be engaged.—LAVINGTON, Lansdowne Road, Clapham, S.W. 2549

WANTED, Shift Engineer for small D.C. power station. Belliss engines, batteries, &c.; ineligible—Apply, stating wage required and previous experience, MANAGER, Electricity Works, Grantham. 2527

WANTED, skilled Mechanics for London works, (controlled firm), experienced in lathe work and repairs to small machinery. No person residing more than 10 miles away, or already on Government work, will be engaged.—State age, experience and wages required, 2522, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WIREMAN wanted for house wiring and general repairs.—Apply, stating wages, experience, and references, to MANAGER, Electricity Works, Felixstowe. 5519

WIREMAN wanted, permanency, electricity undertaking in the Midlands; rate 1s. 3d. per hour, including all bonuses.—Reply, stating age and experience, to 2450, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WIREMEN, electrical, for railway repair shop near Willesden; ineligible; 73s. including bonus, 54 hours. State age and experience.—2518, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WORKS Manager for Carbon Works. Previous knowledge of battery and arc lamp carbons manufacture preferred, but not essential. Must have all-round engineering and commercial experience. Able to control mixed labour—energetic and capable. No person resident more than 10 miles away, or already on Government work, will be engaged.—Write, stating age, experience and salary required, to F. G., Fuller's, Woodland Works, Chadwell Heath, Essex. 2577

YOUTHS wanted to gain experience in switchboard work. No person resident more than 10 miles away, or already on Government work, will be engaged.—CECIL HODGES, LTD., 105, Dalston Lane, London. 5516

APPOINTMENT FILLED.

BOX 5353.—Applicants who applied for this post are thanked, and informed that the vacancy has been filled. 5497

SITUATIONS WANTED.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
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ACCUMULATOR Maker, knowledge self-starters, car lighting and petrol engines, desires situation national importance.—5551, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER, discharged through wounds (age 25), seeks employment with electrical engineers or to be taught power station work; experience light, bells and magneto repairing; state wages.—5539, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER, Manager to large firm of Electrical Contractors, shortly at liberty, desires similar position; thoroughly experienced in modern lighting and power schemes.—5481, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER seeks change. Complete charge maintenance, engines, boilers, electrical plant, 22 years' experience, low category.—5491, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER seeks change, thoroughly experienced in manufacture and testing of instruments, signalling gear, &c. Sound technical ability; excellent testimonials and references.—5538, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER seeks responsible position, extensive skilled, practical, technical, and commercial experience; formerly managing engineer leading London contractors; also own business; over military age. £220; eminent references.—5418, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

SITUATIONS WANTED.—*Continued.*

ADVERTISER seeks situation, to take charge of private installation or factory plant, for the end of September. Good refs.—5512, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER, with considerable experience in lift and crane erection and repair; would join another in repair business. Could provide small capital and find work.—5388, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Engineer desires an appointment; over 12 years' experience in the generation and distribution of electrical energy.—5311, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

BUYER, keen and businesslike, desires change, first-class electrical and mechanical experience, used to detailed work, storekeeping, shops and drawing office training.—5450, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CONTRACTORS' Assistant desires change; 20 years' experience installation work, mostly Government contracts.—5542, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CONTRACTORS' Electrical Engineer, eight years' experience in low-tension and extra-high-tension cable laying and overhead line contracts; well up in power installation work in mills, and lighting distributions for camps; can handle large gangs of men, and get contracts through against time.—5537, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN, with experience in E.H.T. and D.C. gear, desires position as assistant estimating engineer or leading position in D.O.—5401, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Draughtsman requires spare time work. Designing, detail drawings, patent drawings, &c.—5547, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, M.J.I.E., qualified radiographer, wants situation either travelling or as radiographer; good address.—5534, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer seeks charge of small undertaking; power station preferred; home or abroad.—"ENGINEER," 27, Chetwode Road, Balham, S.W. 17. 5531

ELECTRICAL Engineer (35), thoroughly experienced in every department of electrical contracting business, desires position with firm engaged on Government work.—5543, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN Assistant seeks light situation; age 17½. Ineligible; good experience.—E. I., 106, Crisp Street, Poplar. 5513

ELECTRICIAN-Engineer desires change out of London; now employed as works manager; thorough knowledge of power, plant, motors, house and factory wiring, telephones, &c.; experienced general estimating.—5490, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN, First-class. All systems, or take charge.—"ELECTRICIAN," 167, Wandsworth Bridge Road. 5553

ELECTRICIAN, maintenance, good all-round hand, electric lifts, cranes, motors, rotaries; ineligible.—5389, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN requires permanency; used to erection and maintenance of factory and works plant.—5550, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN-Wireman seeks situation; lighting and power, factory or private plant.—A., 28, Cavendish Dwellings, Allen Street, E.C. 1. 5536

ENGINEER, Electrical and Mechanical, seeks a change; doing own alterations, own erecting. Charge of large works; 22 years' experience. A reliable all-round, practical mechanic. Work of National importance; London or suburbs.—5410, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER, electrical and mechanical (44), ineligible. Over 20 years' experience, technical, wiring, installation, station steam, gas, oil mains. Low salary.—5548, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER-Electrician (ineligible) desires charge of private installation.—5545, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER Electrician or Handyman seeks employment of National importance (50), medical category 2.—5400, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER, Mechanical and electrical, wants work in Midland area (part time), inspecting, testing, or progress.—RENDELL, Hampstall Cottage, Stourport, Worcs. 5455

MANAGER or Foreman, Electrician-Engineer; power, plant traction, wiring, distribution, estimating, &c. Over 20 years' experience.—5437, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PROGRESSIVE position as Draughtsman-Designer on electrical accessories work. State approximate salary offered.—5404, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS WANTED.—*Continued.*

RE-ENGAGEMENT as Overhead Linesman; 22 years' experience on maintainments and construction; excellent references from municipals and contractors.—5501, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SOUTH Wales preferred.—Electrical and Mechanical Engineer, having previous experience there, desires change. 17 years' experience. Estimating, erecting and supervising A.C. and D.C. power, and lighting all kinds of engineering industries. Technical with real practical abilities. Organiser, accustomed to control men. Present sales and installation engineer, municipal supply authority.—5518, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WORKS Electrical Engineer (aged 29), discharged service, strict disciplinarian, would be glad to hear of a situation, home or abroad, where initiative and organising ability would be appreciated. Salary £6 10s. during war.—5533, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PARTNERSHIP.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
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LIFT Engineering. An old-established London firm, manufacturing electric lifts, have opening for energetic young man with thorough technical and commercial experience of lift business, with view to partnership. No person resident more than 10 miles away, or already on Government work, will be engaged.—In first place, write fully, in strict confidence, to E. S. DAVIDSON, Atlantic House, Holborn Viaduct, E.C. 2407

AGENCIES.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.).
Box Number and ELECTRICAL REVIEW address count as seven words.

A.A.—ELECTRICAL and Mechanical Engineer (35), A.M.I.C.E., 16 years' experience of large plant, erection and power works running, is able to devote several hours daily to technical or commercial work. First-class technical ability in both steam and electricity; good business organiser and pushing personality. Would like to be engaged in London District on the preparatory steps for whole-time business drive after war.—5486, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

A FIRM of Manufacturers specialising in A.C. motors require Representatives to open Sales Offices in the following centres: Glasgow, Manchester, Birmingham, and Bristol.—State experience and remuneration required; replies treated as strictly confidential.—2417, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR SALE.

COUNTY BOROUGH OF NEWPORT.

Electricity Department.

ARC LAMP CARBONS.

THE NEWPORT CORPORATION have for disposal a large quantity of Arc Lamp Carbons (flame and ordinary). Full particulars, together with Schedule and Form of Tender, can be obtained on application to A. NICHOLS MOORE, M.I.E.E., Borough Electrical and Tramways Engineer, Town Hall, Newport, Mon.

All tenders must be delivered at my Office not later than 10 a.m., MONDAY, SEPTEMBER 23rd, 1918.

The Corporation do not bind themselves to accept the highest or any tender.

ALBERT A. NEWMAN,
Town Clerk.

Town Hall,
Newport, Mon.
September 10th, 1918. 2559

ELECTRIC MOTORS.

SALE or Hire. Second-hand Machines in Stock. ARMATURES and Coils repaired at shortest notice.

THE TITAN ELECTRICAL CO.,
9/11, Eagle Street, W.C.
'Phone: Central 13,191.

CUNNINGHAM, LIMITED.

SMALL Motors and up to 300 H.P. rewound and repaired.

Estimates free. 171, Edgware Road,
'Phone: "5173 Padd." London, W. 2.

(Continued on next page.)

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

ONE 80-H.P., 3-phase, 50-period, 400/500-volt Slip-ring Motor, 1500 R.P.M.

Two 25-H.P., 415-volt, 50-period, 3-phase Slip-ring Motors, 960 R.P.M.

One 5-H.P., 415-volt, 50-period, 3-phase Squirrel-cage Motor, 1400 R.P.M.

One 30-H.P., 220-volt, single-phase, 50-period, 960-R.P.M. Slip-ring Motor.

Two 25-H.P. ditto.

One 24-H.P. ditto.

One 15-H.P. ditto.

Two 130-H.P., 200-volt, D.C., shunt-wound, 3-pedestal, bearing type Bruce Peebles Motors, 300 R.P.M., with special switch pillars.

One 20-H.P., 200-volt, D.C., compound interpole Motor, 700 R.P.M.

Two 2-H.P., 220-volt, D.C., totally enclosed vertical spindle Motors, 2200 R.P.M.

A large number of 100/110-volt D.C. Motors, from ½ H.P. to 1 H.P.

THE VICTORIA ELECTRICAL PLANT CO.,
Spenser Street, Westminster, S.W. 1.

Telephone: Victoria 4026. Telegrams: "Vicminster, Sowest, London."

2452

MACHINERY FOR SALE.

One	27-H.P.,	825	revs., 400/500-volt,	B.T.H.
One	25 ,,	960	,, ,,	Electromotors, Ltd.
Six	25 ,,	670	,, ,,	Lancs. Dynamo Co.
Four	25 ,,	835	,, ,,	G.E. Co.
Four	25 ,,	810	,, ,,	Siemens.
One	20 ,,	750	,, ,,	G.E. Co.
One	17 ,,	1200	,, ,,	Electromotors, Ltd.
One	16 ,,	800	,, ,,	Morris, Hawkins.
One	15 ,,	725	,, ,,	Lancs. Dynamo Co.
Two	10 ,,	1400	,, ,,	Electromotors, Ltd.
One	5 ,,	950	,, ,,	G.E. Co.
Four	5 ,,	815	,, ,,	,,
Six	1 ,,	800	,, ,,	,,

ALL SPEEDS ON 500 VOLTS, DIRECT CURRENT.

Three	5-H.P.,	1300	revs.,	220-volt, D.C.
Three	1 ,,	1500	,,	,,
Four	3 ,,	1400	,,	,,
Four	2½ ,,	1400	,,	,,
One	15 ,,	900	,,	,,

And numerous Motors for A.C. and D.C.

OUR OWN STOCK.

Full details with prices from—

C. J. FERGUSON & SONS,
54, Chiswell Street,
London, E.C. 1. 2509

FOR SALE.

DIRECT-CURRENT MOTORS.

100/110 volts, 3, 4, 5, 6, 15, 25, 30, 80 and 150 H.P.
220/250 ,, 2, 5, 8, 11, 13, 30, 50, 60 and 120 H.P.
440/500 ,, 2, 5, 10, 17, 25, 30, 35, 40, 50, 68, 75, 130, 216 and 500 H.P.

THREE-PHASE MOTORS.

440/500 volts, 4, 5, 10, 15, 25, 45, 50, 60 and 70 H.P., 50 cycles.
,, 5, 11, 14, 17, 21, 30, 50 and 80 H.P., 25 cycles.

All in stock ready for immediate delivery.

THE PHŒNIX ELECTRICAL CO.,
32—36, Broomielaw,
Glasgow. 2483

COUNTY ASYLUM, WHITTINGHAM.

THE Committee of Visitors of the above-named Asylum have for disposal two direct-current, shunt-wound Motors of 26 H.P. and 10 H.P. The 26-H.P. machine has spare armature field coil and brasses. The 10 H.P. has spare field coil only. Both machines have a starter (tramway type), and the makers are Royce & Co., Ltd.

Tenders, with price, should be submitted to the undersigned not later than SEPTEMBER 20th.

H. E. MORGAN,
Clerk and Steward. 2532

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

"VICTOR" Full Automatic Turret Lathe, by Smith and Coventry, with 2¾" hollow spindle.
3½" Centres "Lo-Swing" Lathe on 8' bed.
Profiling Machine, by Muir & Co., with T-slotted table, working surface 12" by 15".
No. 3 Four-spindle "Acme" Automatic Screw Machine, for ¾" bars.
Motor-Driven Face Milling Machine, by Hetherington and Co., facing head 18" diam.
Portable Electric-Driven Saw Bench, table 48" by 22", to take saws 30" diam. 8-B.H.P. Motor.
Portable Electric-Driven Saw Bench, table 3' by 2' 6". 6-B.H.P. Motor, D.C., 480 volts.
22-B.H.P. Crossley Gas Engine, tube ignition, with cyl. 9½" diam. by 18" stroke.
20-B.H.P. Crossley Gas Engine, tube ignition, with cyl. 8½" diam. by 18" stroke.
14-B.H.P. Grice Gas Engine, tube ignition, with cyl. 8" diam., by 18" stroke.

CATALOGUE of Stock MACHINERY. 2-3000 LOTS.
Free on Application. Inspection invited.

THOS. W. WARD, LTD., ALBION WORKS,
Tel.: "Forward, Sheffield." SHEFFIELD.

R. H. LONGBOTHAM & CO., LTD., WAKEFIELD,

and at Milburn House, Newcastle-on-Tyne.

Tel.: 44 Wakefield; 867 Newcastle. Telegrams: "Engineer, Wakefield."

FOR SALE.

ONE Parsons Steam Turbo Set, 3500 KW., 1200 R.P.M., with alternator field-rotating type and exciter complete; 6000-volt maximum load, 40 cycles.

One ditto, 1500 KW., 2-phase, 2000 volts, 50 periods.

One Willans-Parsons Steam Turbo Set, 1200 KW., with Alternator, 1200 R.P.M., 200 lbs. to sq. in., 11,000 volts, three-phase, complete with exciter, also condensing plant, air, and circulating water pumps, &c.

One 225-KW. Generating-Set, engine tandem comp. type, 300 H.P., with Corliss Valve Gear, &c., B.T.H. Generator, 500 volts, compound wound.

One Triplex Lift Pump and Motor, capacity 12,000 galls. per hour, motor 500 volts, by the British Electric Plant Co. 5277

MACHINERY FOR SALE.

GENERATING SETS, D.C.

One 500-KW. Willans-E.C.C., 420/500 volts.
Three 256-KW. Belliss-Siemens, 460/500 volts.
One 220-KW. Willans-A.E.G., 220 volts.
One 200-KW. Allen-Parker, 460/500 volts.
One 180-KW. Anderson-Mavor 220/230-volt Set.
One 160-KW. Belliss-G.E.C., 460/500-volts.

TURBO-GENERATORS, A.C. AND D.C.

One 1,000-KW. A.E.G. 500 volts, 50 cycles, 3-phase, with condensing plant complete; the whole equal to new.
One 500-KW. Parsons, 460/530 volts, with condensing plant complete.

Apply, FRANK GILMAN,
Lightwoods Hill, Birmingham. 2128

MACHINERY FOR SALE.

ONE Generating Set Comprising:—
"Howden" Enclosed Compound Engine for 150 lbs. steam pressure, direct-coupled to compound interpole generator, having an output of 300 KW. at 240 volts, 375 r.p.m.; built in 1910, and in first-class order.
Specification and print on request.

THE PHŒNIX ELECTRICAL CO.,
32—36, Broomielaw, Glasgow. 1943

ELECTRIC DYNAMOS AND MOTORS.

MACHINES always available for Sale or hire.
ARMATURES and FIELD COILS rewound or repaired without delay.

'Phone: 5773 Holborn. MACDONALD, SYER & CO., LTD., 295, Gray's Inn Road, W.C. 1. 8485

(Continued on next page.)

FOR SALE. - *Continued.*

GENERATOR SWITCHBOARDS.

IN perfect order and as new :—

One 100/140-volt, 10-KW. size, with circuit-breaker, &c.

One 460-volt, 45-KW. size, with shunt regulator.

One ditto, with change-over switch, and suitable for two generators.

DRUMMOND & CO., Middlesbrough. 5525

ELECTRICAL PLANT FOR SALE.

ONE 300-KW., 220/250-volt Generating Set, comprising "Howden" enclosed compound engine, coupled to compound interpole Generator.

One 500-KW., 220/250-volt Generating Set, comprising "Bellis" enclosed compound engine coupled to compound-wound Generator, and complete with condensing plant.

One 450-KW., 500-volt Set, as above, with or without condensing plant.

THE PHŒNIX ELECTRICAL CO.,
32—36, Broomielaw,
Glasgow. 2429

CABLE FOR SALE.

CABLE From Stock, 1/18, 1½ mile ; 3/22, 4 miles ; 7/16, ⅛ mile, 600 meg. grade, taped and braided.

5492. ELECTRICAL REVIEW,
4, Ludgate Hill, London, E.C. 4.

BRASS SCREWS.

FOR Disposal, 1,600 gross round head Brass Screws, British manufacture, ⅜" Whitworth by 5/32" long. Offers wanted for the whole quantity or a substantial part.

2539, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

SECRET SERVICE LAMP SIGNALLING TELEPHONES.

NINE 10-way Interphones (five wall and four table sets), with central cross-connection board, for sale. Quite new, never been in use.

Apply for particulars to—

NORTH BRITISH ENGINEERING EQUIPMENT CO.,
Milburn House, Newcastle-on-Tyne. 5514

Cheap prepaid Advertisements relating to second-hand goods and specified Articles are inserted under this heading at the rate of One Penny Per Word (minimum 1s).

TRADE RATES ON APPLICATION.

Box Number and ELECTRICAL REVIEW address count as seven words.

CARBON Lamps, 100 volts, 16 C.P. Second-hand ; excellent condition. 8d. each.—HASTINGS, 9, Rifle Crescent, Six Ways, Aston, Birmingham. 5520

CONTINUOUS current, modern type, Multipolar Dynamo for sale. Output 200 KW., 460/520 volts as shunt, or 225 KW., 500/550 volts as compound ; 25 % overload for one hour, 350 R.P.M. Has half-coupling, outer bearing and shunt regulator, but no bedplate. Suitable for coupling direct to engine or may be used as a motor. Splendid condition. Price £400, delivered Ipswich.—IPSWICH CORPORATION ELECTRIC SUPPLY DEPARTMENT. 2523

DYNAMOS for Sale, 57½ KW., 110 volts, 50, 75 and 100 KW., 220 volts.—PHŒNIX, 32, Broomielaw, Glasgow. 2412

DYNAMOS suitable for direct coupling :—150 KW., 150 revs. ; 150 KW., 430 revs. ; 150 KW., 230 revs. ; 350 KW., 250 revs. ; 400 KW., 300 revs. ; and 600 KW., 260 revs., 440/550 volts.—PHŒNIX, 32, Broomielaw, Glasgow. 2414

DYNAMOS, 3000, 1500, 1000 and 750 amperes at 6 volts; also smaller sizes. Apply for lists.—CANNING & Co., Electro-Platers Engineers, Birmingham. 7769

ELECTRIC Motors and Dynamos, Sale or Hire. Always a large stock of nearly new guaranteed machines. Immediate delivery.—ELECTRO-GENERATOR CO., 1A, Shepherd's Bush Road, W. 'Phone : 488 Hammersmith. 5347

ELECTRIC Motors, 216 H.P., 230 R.P.M., and 500 H.P., 150 R.P.M., 440/500 volts ; also large number of smaller machines.—PHŒNIX, 32, Broomielaw, Glasgow. 2413

FOR Sale, a number of Reversing Controllers by Royce, Westinghouse and other makers, and suitable for series-wound Motors from 7½ to 20 H.P. Also a few three-phase ditto.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2545

FOR SALE.—*Continued.*

FOR Sale, a number of three-phase, 50-cycle, 400/500-volt Motors. Also a few 440-volt, 25-cycle ditto, 6 to 80 H.P.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2546

FOR Sale, about three miles of new 7/22 Silicon bronze bare overhead Conductor.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2564

FOR Sale, about two miles twin 1/18 lead-covered and armoured 11,000-volt Cable ; also about one mile 3-core 1/16 ditto.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2565

FOR Sale, brand new 40-H.P., 480-volt, 600 R.P.M., enclosed, ventilated, compound-wound, 3-bearing Motor, by the Electrical Construction Co., Ltd., with "Empire" push button control panel.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2497

FOR Sale, Duplex Generator, by Mather & Platt, Ltd., comprising two 50-KW., 220-volt, multipolar generators, coupled on combined bedplate with driving pulley in centre, and clutch at each side of pulley. Price £390.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2498

FOR Sale, New Expanded Metal Transformer Cage, 10 ft. × 7 ft. × 5 ft., with doors at end ; £20.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2544

FOR Sale, new Westinghouse 3-phase Switch Cubical for 200-H.P., 440-volt Motor or Generator.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2543

FOR Sale, one Tangye 97-B.H.P., 190 R.P.M., horizontal single-cylinder Gas Engine, complete with fly-wheel, pulley 66" diameter × 24" wide, steel air receiver for compressed air starting, and arranged for forced circulation for cooling. In practically new condition.—2540, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale.—One 5-H.P. totally enclosed 440-volt Mawdsley's Zone Motor, 1,500 revs., as new, £40. One 6-H.P. protected type Newton Zone Motor, 440 volts, 1,250 revs., £45. One Alley and MacLellan 50-H.P., 2-cylinder vertical Engine, 100 lbs. pressure, only run 1,000 hours, £70. One Generator, 60 volts, 100 amps., 4-pole, interpole, £65. One Generator, 110 volts, 60 amps., new commutator ; make, Harris, Bradford ; 800 revs., ring oil bearings, pulley and slide rails, £25. One ditto, 110 volts, 25 amps., £15 10s. One 4½-H.P., 460-volt, 1,000 revs., protected 4-pole, shunt-wound Motor, £40. One 6-H.P., 400-volt, 50-cycle, 3-phase, 750 revs., Slip-ring Motor, only run two months, £50. One 12-H.P., 460-volt Motor, speed 375, shunt wound, £95. One 20-H.P., 800 revs., £110. —BARCLAY HOUSE, Helvellyn Street, Keswick. 5503

FOR Sale, Private Electrical Plant, consisting of Paxman's 12-H.P. loco. type Boiler, Berryman's Feed Heater, Mumford double cylinder Feed Pump and Injector ; Paxman's 12-H.P. horizontal compound Engine, direct coupled to Lancashire Dynamo and Motor Co.'s Shunt Dynamo, 275-volt, 60 amps., and 200-volt, 90 amps., speed 140 revs. ; Motor, 4-H.P., enclosed 4-pole, 200-volt, 300 revs., with Sturtevant starting panel in iron box ; Motor, ¾-H.P., 200-volt, with starter ; about 1½ miles No. 5 bare solid Copper Overhead Wire, Insulators, and Lightning Arresters. All in good condition. On view by appointment till September 25th.—ENGINEER, Gaunts House, Wimborne, Dorset. 5523

FOR Sale, Testing Set, 200 volts, Eversheds, in good condition.—F. W. COOK & Co., Bargate Street, Southampton. 5440

FOR Sale, Traction Booster, comprising 216-H.P., 440-volt, 230 R.P.M. Motor, direct coupled to 150-KW., 500/550-volt Generator, modern machine by Brush Electrical Engineering Co., Ltd.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2541

FOR Sale, twelve 20-H.P., 500-volt, enclosed series-wound Traction or Crane Motors, by the B.T.H. Co. ; £50 each.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2542

FOR Sale, two high-pressure Berryman Simplex Patent Water Heaters, in new condition. Also ten 12" standard Glenfield Sluice Valves. Three T pieces 30" long 15" dia. Three packing Pieces 30" by 15", all standard drilled.—M. ERDMAN & SON, Rollins Street, Old Kent Road, S.E. 15. 2524

FOR Sale, two three-phase, 10-H.P., 415-volt, 50-cycle, slip-ring Motors, direct coupled to Generators, 1500 amps., 4 volts ; one Dynamo, 100 volts, 100 amps. ; one Cabinet Vacuum Cleaner, 240 volts ; one wrought-iron Pulley, 8 ft. diam. by 20 in. 5½ in. bore. —BARNETT & SOANS, Electricians, Stoke-on-Trent. 5499

FOR Sale, 5-H.P., 480-volt Rhodes Motor, interpole, starter, bedplate, pulley, speed 1100.—J. WOOLLARD, 248, Albion Road, N. 16. 5526

FOR Sale, 30-H.P. Lancashire Planing Machine Drive, consisting of 30-H.P. motor, together with suitable motor-generator to run off 220 volts, and necessary switchgear.—GREENWOOD AND BATLEY, LTD., Albion Works, Leeds. 2449

FOR Sale, 100-KW. Generating Set, Browett, Lindley compound engine, direct coupled to Laurence, Scott generator, 460 volts, 220 amps., 400 R.P.M., 16-KW. Generating Set, vertical enclosed engine, direct coupled to generator, 100 volts, 160 amps., 500 revs. ; by Cromptons. New 50-H.P. vertical, compound, enclosed, central valve Engine, 7" × 12" × 5", 500 revs., 150 lbs. pressure ; suitable for direct coupling to generator.—R. H. PATTERSON & Co., LTD., Forth Street Works, Newcastle-on-Tyne. 2501

(Continued on next page.)

FOR SALE.—*Continued.*

FOR Sale, 100/150-volt, 40-amp., shunt Dynamo, direct coupled to Westinghouse gas engine; also suitable Dowson gas plant, 54 cells and charging board. Splendid condition.—WINDER, Cross Belgrave Street, Leeds. 2418

FOR Sale, 500-H.P., 460-volt, 150 R.P.M., 12-pole, compound interpole Motor, by Crompton, with rope pulley, &c.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2499

GENERATING Sets, 300 and 500 KW., 230 volts, with or without condensing plant.—PHŒNIX, 32, Broomielaw, Glasgow. 2411

JOB Line, New Cable, vulcanised India rubber and taped—not braided. All sizes, 1/20 to 7/14; suitable for aerial or tunnelling work, about 10 miles, to be sold cheap.—LAKE, 132, Upper Thames Street, London, E.C. 4. 5471

MACHINERY for Sale.—290-KW. Generating Set, by Belliss. Silvertown, 600 volts, 490 amps. 3-panel slate Switchboard with accessories for above. Two 60-H.P. Compound Motors, 500 volts, 775 R.P.M., by Dick, Kerr. Three 17-H.P. drip-proof Shunt Motors, 500 volts, 1020 R.P.M., by Phœnix, direct coupled to centrifugal pumps, 30 ft. head; motors will be sold separately if necessary. 2-H.P. Shunt Motor, by Vickers, 500 volts, 1680 R.P.M., with belt-driven Blower for smiths' fires. Four 40-H.P., 500-volt Motors and Sinking Pumps. 11·5-H.P. Gardner horizontal Oil Engine, which has not yet been unpacked from maker's case. Self-contained Electric Friction Hoist for lifting 8 cwt., with 2-H.P. motor, 460 volts. The above plant is practically new, complete with Switchgear and ready for immediate delivery.—Apply 83, THE EXCHANGE, Cardiff. 5409

MESSRS. W. SOUTTER & SONS, LTD., owing to the abnormal conditions due to the war, purpose closing down the larger portion of their showrooms at Bath House, 58—60, Holborn Viaduct, and in consequence are prepared to consider reasonable offers for the samples of Electric and Gas Fittings on show there (in small or large lots). This is an opportunity that should not be missed. Mr. E. H. Cooper is in attendance daily (1 to 2 o'clock excepted) and will be pleased to give particulars and any information to callers who wish to inspect the goods. There are also some very substantial tables, stands, panels, lino, cable and conduit fixtures to be disposed of on the same terms. 5453

METERS—Four 5-amp, M.H. type, form A.A.7., 210 volts, D.C., B.T.H. Service Meters; nearly new; 41s. each delivered.—ELECTRICITY WORKS, Sundridge, Sevenoaks. 5502

ONE 3-B.H.P. one-phase Langdon-Davies Motor, 100 volts, 75 ~, speed 2140, coupled to two Mather & Platt turbine pumps, 50 gallons per minute, 65-ft. head, on C.I. bedplate.—PUDNEY, Bury St. Edmunds. 5436

ONE 100-volt Compound Dynamo, 30 to 40 amps., for sale; armature just rewound. — 2491, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ONE 200-KW. Steam Generating Set for immediate sale, Willans-Mather & Platt, 220 or 440 volts. Perfect working condition.—JENNINGS, West Walls, Newcastle-on-Tyne. 1513

PLATING Dynamos.—Two Motor-Generators, comprising 500-amp., 10-volt Dynamo, coupled to 200-volt D.C. motors at 900 revs.; also one 1500-amp., 5-volt, 640 revs., Canning's Dynamo. —Full particulars, C. J. FERGUSON & SONS, 54, Chiswell Street, London, E.C. 1. 2510

THREE second-hand Tudor 9-plate Accumulators in lead-lined teak cases, 2000 amp.-hour capacity.— H. S. WHITELEY, 79, Shoe Lane, E.C. 4. 2503

THREE 8-H.P., 220-volt, brand new, shunt-protected Motors, 1600 revs.; just unpacked.—DRUMMOND & CO., Middlesbrough. 5305

TWO 4-H.P., single-phase Motors, by Bergmann, with starters.—MARTINS, 320, Witton Road, Birmingham. 5487

TWO 250-KW. Belliss Alternator Sets, each comprising a Compound Enclosed Engine, with E.C.C. Alternator, 3000 volts, 50 periods; quite modern, and for immediate delivery.—HARRY H. GARDAM & CO., LTD., Staines. 1852

6-INCH Gwynne Centrifugal Pump, direct coupled to 17-H.P., 460-volt, shunt, Westinghouse Motor, with control panel, only used short while, condition perfect.—DRUMMOND & CO., Middlesbrough. 5452

25-H.P., 3-phase slip-ring Motor, by Siemens, 440 volts, 60 cycles, with short-circuiting device; also complete starting gear.—DRUMMOND & CO., Middlesbrough. 5308

31-H.P. Siemens Motor, squirrel-cage, 500 volts, three-phase, 50 periods, 1450 revs.—BURY ELECTRICAL PLANT CO., LTD., Phœnix Street, Bury. 5509

44-KW., 110-volt D.C. Generator, compound wound, three-bearing type, with rope pulley and slide rails; speed, 600. —DRUMMOND & CO., Middlesbrough. 5306

65-B.H.P., 3-phase, slip-ring Induction Motor, 440 volts 50 cycles, 480 R.P.M., no pulley or slide rails, maker B. T.H. Co., Ltd. Also oil-immersed, Triple-pole Switch, air-break Starting Switch, and 30 ft. 37/18 3-core, paper-insulated, lead-covered, armoured Cable Modern machine, in first-class condition, available for immediate delivery. Price for the lot on site, Manchester, £200.—DRAKE & GORHAM, Ltd., 47, Spring Gardens, Manchester. 2561

75-KW. E.C.C. Machine, 110 V., D.C. 6 poles, 550 revs., with rails and shunt regulator.—BURY ELECTRICAL PLANT CO., LTD., Phœnix Street, Bury. 5508

FOR SALE.—*Continued.*

100-VOLT, A.C. Langdon-Davies 2-horse Motor, A.C. and starter in perfect condition, with wires, main fuse, and cut-outs, tubing, and slide rails; bargain £20 or offer. Grinding Set, comprising two grinding heads, two dry emery wheels, two wet stones, two brushes, 24 in. laminated wood wheel, four Plumner blocks, 5 ft. 1 in. steel axle tube, two pulley wheels. £6 10s. Seen by appointment.—Apply, 15, Brighton Road, South Croydon. 5524

225-KW. Willans-Siemens Set, comprising Willans enclosed triple-expansion Engine, 360 H.P., direct coupled to Siemens 6-pole Generator, 410 V., D.C., 550 amps., 360 revs.—BURY ELECTRICAL PLANT CO., LTD., Phœnix Street, Bury. 5505

250-KW. Belliss-E.C.C. Set, comprising Belliss high-speed, 3-crank, compound Engine, direct coupled to E.C.C. Generator, 440/460 V., D.C., 560 amps., 380 revs., with Korting Ejection Condenser; also spare Armature.—BURY ELECTRICAL PLANT CO., LTD., Phœnix Street, Bury. 5504

300-H.P. Siemens Machine, 6 poles, 410 V., D.C., 550 amps., 360 revs.—BURY ELECTRICAL PLANT CO., LTD., Phœnix Street, Bury. 5510

450-K.V.A. E.C.C. Generator, 110 V., single-phase, 25 periods, 730 revs., with exciter.—BURY ELECTRICAL PLANT CO., LTD., Phœnix Street, Bury. 5507

500-KW. Steam Generating Set, comprising a Belliss triple-expansion engine, coupled to an alternator by the Electric Construction Co., Wolverhampton, 3000 volts, 50 periods, with Wheeler-Worthington independent surface condensing plant; modern plant in first-class condition, and for immediate delivery. —HARRY H. GARDAM & CO., LTD., Staines. 1851

500-KW. Steam Set, comprising triple-expansion enclosed engine, coupled to Westinghouse multipolar generator, 440/490 volts, D.C. For prompt delivery.—HARRY H. GARDAM AND CO., LTD., Staines. 1413

600-H.P. E.C.C. Motor 2000 volts, two-phase, 50 cycles, 730 revs., slip ring, brush lifting and short circuiting device with liquid starter.—BURY ELECTRICAL PLANT CO., LTD., Phœnix Street, Bury. 5506

20,000 FLAME Arc Lamp Carbons, 6 m/m to 12 m/m diameter, 12 to 25¾ inches long, metal cored and non-metal cored, by Siemens, to be sold cheap. Also 500 Searchlight Carbons, 33 m/m to 10 inches, cored.—LAKE, 132, Upper Thames Street, London, E.C. 4. 5472

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ELECTRICAL Manufacturing and Motor Repair Works for Sale, situated in London, good staff and machinery. Good profits assured, with £3,000 worth of orders in hand. Reason for disposal, lack of capital.—5527, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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6,000 CARBON FILAMENT ELECTRIC LAMPS, pear shape, plain, wanted for re-sale; Dutch make or otherwise. State rock bottom for spot cash, delivered free to north of England.

Quantity.				
216	...	220 volts	...	25 C.P.
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1,050	...	220 ,,	...	50 ,,
750	...	230 ,,	...	32 ,,
48	...	240 ,,	...	25 ,,
48	...	240 ,,	...	50 ,,
1,250	...	250 ,,	...	32 ,,
48	...	250 ,,	...	50 ,,

What have you to offer? Write fully.
5435, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

GALVANISED BOLTS WANTED.

REQUIRED, about 12,000 galvanised ½" Bolts, suitable for use with Sinclair Insulators, complete with nuts and washers.

PECKHAM, DUCAMP & CO.,
90, Charing Cross Road, London, W.C. 2. 2516

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.).
Box Number and ELECTRICAL REVIEW address count as seven words.

ACCUMULATORS wanted for refining purposes. Obsolete Generating Sets, Dynamos, Motors, and all kinds of Machinery. Scrap Cable, Arc Lamps, Meters, Metal Residues, and Scrap Metals of every description purchased for prompt cash, town or country.—Apply A. BROWN & SONS, 142, Lower Clapton Road, London, N.E. Telephone: Dalston, 555. Telegrams: Secondhand, Lowclap, London. Established 1860. 4358

A.C. and D.C. Motors (second-hand), any type, any condition, wanted for prompt cash.—A. LEAROYD & SON, Bridge Works, Heatherley Street, Clapton, N.E. 5391

(Continued on next page.)

ARTICLES WANTED.—*Continued.*

A. LEAROYD & SON, Bridge Works, Clapton, N.E.—Telephone Dalston, 2278; Telegrams: Frangible, Lowclap, London—buys for prompt cash every description of second-hand Generating Sets, Accumulators, Motors, Transformers, old Arc Lamps, Meters, Cable, Scrap Metals, Metallic Drosses, &c., &c. Enquiries solicited. Established over 50 years. 5392

A 1 CASH Prices given for Electric Cable, Flexible Wire, Electrical Accessories, &c.—Apply DAVIS, 11, Sun Street, E.C. 2. 1424

BATTERY, new or second-hand, wanted, 50 or 100 volts, about 200 to 300 ampere-hour capacity.—5480, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DYNAMOS, Motors, Arc Lamps, Meters, Scrap Cable, Iron, Metals or Machinery purchased for cash in any quantities.—J. HYAMS, 11, Glengall Terrace, Old Kent Road, S.E. Telephone: 3339 Hop. 5158

GENERATING Set wanted, 100 KW. or near, 110 volts, 150 lbs. steam pressure. — 2563, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

GENERATORS, one or two wanted, 60/70 volts, 400/500 amps. D.C. Fullest particulars, lowest terms.—TILNEY, Olympia, Newport. 5457

MOTOR-Generator for Battery Charging wanted; Motor, 220 volts, D.C.; Generator, about 25 volts, 10 amps. Or Generator only of about this size.—WILFRID TAYLOR & CO., Lowgate, Hull. 5522

NEW or Second-hand Tubing and Fittings wanted.—WALLACE, 58, High Street, Bloomsbury. 2307

OIL-driven Electric Light Plant wanted, 100 or 50 volts, with battery complete, about 200 to 300 ampere-hours capacity.—5424, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

OLD Cable urgently required, also Lamp Tops.—WALLACE, Cromwell House, High Holborn. 4114

OLD Electric Lamps that have had wire-drawn tungsten filaments in them with glass parts intact, 1½d. each, any make.—104, Craven Park, London, N.W. 10. 5049

OLD Electric Lamps that have had wire-drawn tungsten filaments in them previously wanted, glass parts intact. Agent's price 2d. each.—847, Harrow Road, London, N.W. 10. 4932

OLD Lamp Tops wanted.—5544, ELECTRICAL REVIEW, 4, Ludgate Hill London.

PLATINUM, in any form and quantity, purchased at highest prices by DERBY & CO., LTD., 44, Clerkenwell Road, London.

PLATINUM Scrap purchased in large or small quantities. Highest market value given.—Before selling elsewhere call or post to the old and reliable firm, THE DEPÔT, 156, Charing Cross Road, London. Established 1850. 5511

S.M. Motor required, 2 H.P., 1200 R.P.M., 200 V., or 1 H.P., 600 R.P.M., 100 V.—State price, make, and where machine can be seen, to 2570, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

STEEL Tubes, all sorts, wanted; Lampholders and Metal and Cardboard Shades; Gas Lighters, Static Electric; Screws, round head, and Hexagon Nuts.—DUGDILLS, Failsworth, Manchester. 5052

SURPLUS Stocks Electric Cable, Plant, &c., bought for cash; also scrap cable, dynamos, motors, cells, scrap metals, lamp ends, &c.—LAKE, 132, Upper Thames Street, London, E.C. 5473

TEN yards of lead-covered paper or rubber-insulated, triple-concentric Cable, ·50 × ·50 × ·25.—THE GUILDFORD ELECTRICITY SUPPLY CO., LTD., Surrey. 2574

WANTED, a few 200-volt, 50-period, single-phase Motors, slip-ring type, with starting gear; any size between 5 and 25 H.P.—2492, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, a few 400-volt, 50-cycle, 3-phase Motors, preferably slip-ring type, 5 to 35 H.P.—8133, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED at once for important Colliery, one 80/100-H.P., 500/600-R.P.M., 460/500-volt, D.C. Motor, and one 15/18-H.P., 800/1000-R.P.M., 460/500-volt, D.C. Motor; five panels for 100 to 300 amps., 500-volt, D.C.; three 8″ H.P. Steam Stop Valves; Weir Feed pump, 3000 galls. hour, 120 lbs. steam. Good second-hand plant considered; P4. certificate available.—Fullest particulars to MCLAY, 10, North Parade, West Park, Leeds. 5382

WANTED, Circuit Breakers for 10/20 H.P., 440 V., D.C. State make, condition and price.—WARD, Electrician, Dewsbury. 5546

WANTED, D.C. deadbeat portable Millivoltmeter and Ammeter reading 0/5 amps.; also slide wire Bridge, Testing Set for localising on street mains.—Write, R. P., c/o J. W. Vickers & Co., Ltd., 5, Nicholas Lane, E.C. 4. 5496

WANTED, Direct-Coupled Steam Set, any output from 50/100 KW., will be considered; 440/480 volts, D.C.—State full details, price and where seen, to 2311, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Electric Cooking and Heating Apparatus, Kettles, Irons, Vacuum Cleaners, all voltages. Also Electric Bells, Lamps and Arc Lamp Carbons, and all classes of Accessories and Flexibles.—Fullest particulars to 2316, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARTICLES WANTED.—*Continued.*

WANTED, Generating Set, 500 volts, 50 periods, 3-phase, 100 to 200-KW., Belliss or Browett engine preferred, but would consider other good make.—2494, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, modern Generating Set, about 200 KW., 550 volts, 3-phase, 50 periods, with Belliss or Browett engine preferred.—2562, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Motor-Generator, output 3/5 KW., for 100/150 volts, D.C. Price must accompany offer.—2434, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Motor-Generator, 400 volts, one-phase, or 200 volts, two-phase, to about 70 volts, 80 amps.; also one 440 volts, D.C., ditto.—R. F. WINDER, Cross Belgrave Street, Leeds 2360

WANTED, one Compound High-Speed Vertical Engine, direct coupled to D.C. Generator, 220 volts, 150/200 KW.; steam pressure, 150 lbs. Set must be complete with all accessories.—State makers, date and full particulars of plant, also price f.o.r., 5552, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, one or two large, slow-speed, 2700-volt, 2-phase, 50-period Motors for rolling mill work.—2495, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, small Dynamo for battery charging, 12 to 16 volts, 8 amps.—Full particulars and lowest price, to 5494, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Suction Gas Engine and Plant complete, magneto ignition, 45 to 50 H.P.; also Dynamo, 120 to 150 volts, about 170 amps., shunt, carbon brush gear, ring oilers.—ELECTRICAL WORKS, Pembroke. 5498

WANTED, 50-B.H.P., 200-volt, 3-phase, 50-cycle, 720 R.P.M. Motor with starter, no volt overload releases; also 10-H.P., 460-volt, D.C. Motor.—Full details with lowest prices, BARNETT AND SOANS, Electrical Engineers, Stoke-on-Trent. 5495

WANTED, 200-220 V. D.C. Motor, with Starter, 1 to 2 H.P.—Full particulars, COLEMAN'S GARAGE, Carlow. 5445

WANTED, 200 to 250-H.P., 440-volt, 40-period, 3-phase, 365 R.P.M. Motor, suitable for direct coupling to air compressor.—2496, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, 220-volt, direct-current Motors, moderate speed, 10 to 80 H.P.: quick delivery essential.—2493, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

2-H.P. single-phase Motor at 1000—50 periods, 220 V.; also 2 H.P. 250 V., 25 periods.—A. BARRON & CO., Eastern Boulevard, Leicester. 5444

3 or 4-H.P., three-phase Motor, about 1440 R.P.M., suitable for 400 volts, 50 periods, with or without slide rails and pulley.—KENT ELECTRIC POWER COMPANY, Railway Street, Chatham. 2557

140-H.P. Motor (approximate), single-phase, alternating, 50 periods, 400 volts.—5493, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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Armature repairs and rewinds on the shortest possible notice. 5521

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ENGLISH-Russian-French Technical Translations.—Write to 5475, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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Professor J. W. NICHOLSON, M.A., D.Sc. ...	
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For full information apply to the DEAN or the SECRETARY, King's College, Strand, W.C. 2. 2403

LONDON COUNTY COUNCIL.

HACKNEY INSTITUTE,

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EVENING LECTURE and LABORATORY COURSES are held in Electrical Engineering subjects, including Electrical Measurements, Dynamos and Motors.

For prospectus and full information apply at the Institute.

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Clerk of the London County Council. 2547

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(UNIVERSITY OF MANCHESTER).

Principal: J. C.-M. GARNETT, M.A. (late Fellow Trin. Coll., Cam.).
Vice-Principal: E. M. WRONG, M.A. (Fellow Magdalen Coll., Oxford).

The Session 1918-1919 will open on 3RD OCTOBER. Matriculation and Entrance Examinations will be held in July and September. Matriculated students may enrol for 1918-19 from 1st August, 1918, and if under 18 years of age are eligible for membership of the Officers' Training Corps.

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The Prospectus gives particulars of the Courses leading to the Manchester University Degrees (B.Sc. Tech. and M.Sc. Tech.) in the Faculty of Technology, in the following Departments:—

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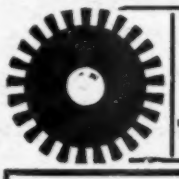

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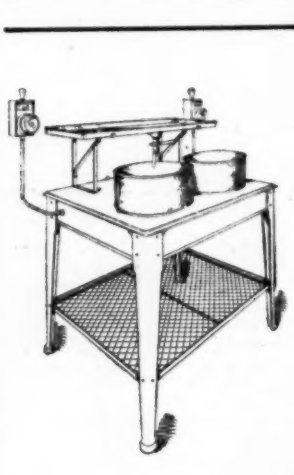

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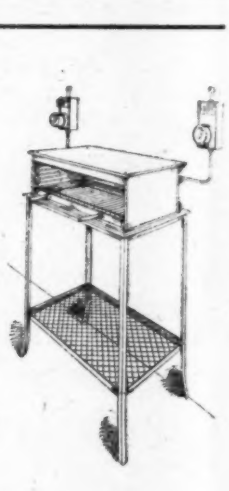

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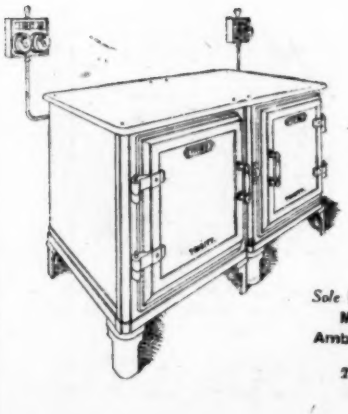
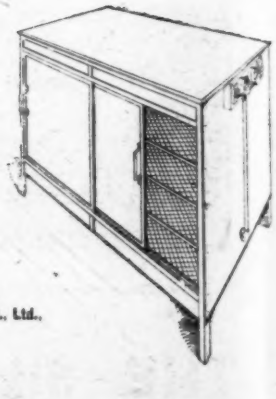


PRICES AND PARTICULARS
ON
APPLICATION.



Sole Wholesale Agents—
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GERRARD 4720.

Manufacturers and Patentees—
The BRITISH ELECTRIC TRANSFORMER CO., Ltd.,
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SOUTHALL 101.

NOTICES RELATING TO PATENTS.

Latest time for receiving 9.30 a.m. Thursday.

John E. Raworth,

Queen Anne's Chambers, 28, The Broadway, Westminster, S.W.1. **Chartered Patent Agent.**

PATENTS AND DESIGNS ACTS, 1907-14.

ELECTRIC CUT-OUTS.

THE PROPRIETOR of British Letters Patent No. 17,345, of 1913, is prepared to sell the patent or to license British manufacturers to work under it. It relates to an Electric Cut-out in which there is a U-shaped fuse strip mounted in an insulating block removably connected to the switch arm. Address :—

BOULT, WADE & TENNANT,
111/112, Hatton Garden,
London, E.C.1. 2475

TO ELECTRICAL ENGINEERS.

THE Owner of Patent No. 28630, of 1913, relating to "Electrolytic Converter for the Transformation of Alternating Currents into Continuous Currents," is desiring of entering into arrangements by way of license or otherwise on reasonable terms for the purpose of practically working and exploiting the invention in this country.—For particulars address MESSRS. ALLISON BROS., 84—86, Chancery Lane, W.C. 2. 2519

OFFICIAL NOTICES.

Latest time for receiving 9.30 a.m. Thursday.

BOROUGH OF STOCKTON-ON-TEES.

THE DISTRICT FUND, GAS AND ELECTRIC COMMITTEES of the Stockton-on-Tees Corporation invite Tenders for the several Articles and Stores required by them for the six months ending March 31st, 1919.

Forms of Tender, Conditions of Contract, and all information may be obtained respectively from the BOROUGH SURVEYOR, the GAS MANAGER, and the ELECTRICAL ENGINEER.

Persons desirous of tendering should state the articles they desire to offer, and for which Department. Tenders, endorsed "Stores," marked for the particular Committee for which they are intended, and on the printed Form of Tender only, to be delivered to me not later than SEPTEMBER 20th, 1918.

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Town Clerk.

Borough Hall, Stockton-on-Tees.
September 10th, 1918. 2556

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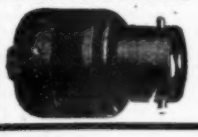

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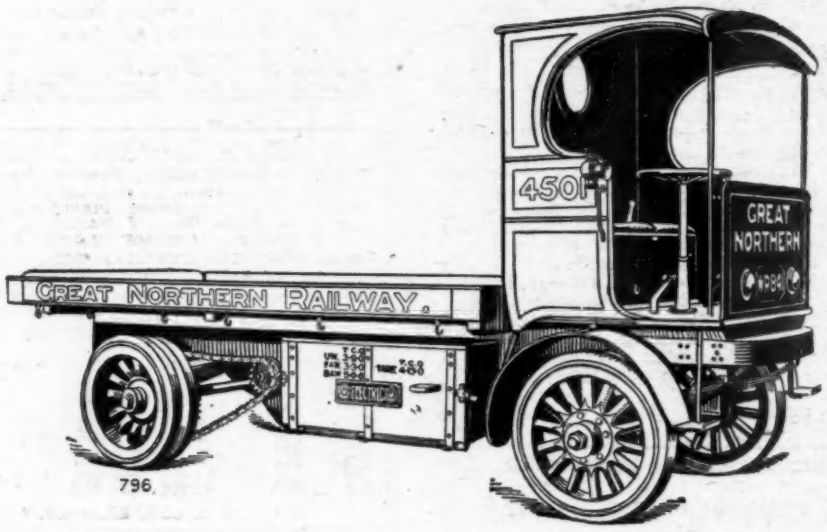
Telephone: SOUTHALL, 59. **The Green, Southall, Middlesex.** *Telegrams: "SOUTHALL, 59."*

"Ironclad Exide"

(Registered)

THE BATTERY FOR COMMERCIAL ELECTRIC VEHICLES.



SUPPLIED TO ALL THE LEADING RAILWAY COMPANIES.

The collection and delivery of goods from a central depot to the surrounding neighbourhood—short haul, frequent stops—is a class of work in which the electric vehicle can show more favourable results than any other form of traction, animal or mechanical.

Send for Circular 40, describing the Cell in detail.

THE Chloride ELECTRICAL STORAGE CO. LIMITED

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Telephone: Museum 333.

TREDEGARS, Ltd.,

WHOLESALE AND EXPORT ELECTRICAL SUPPLIES,

9, Diana Place, Euston Road, N.W. 1,

Also at 47, Exchange Buildings, Birmingham.

The following for Immediate Delivery from STOCK :—

Extra heavy C.G. ½" and ⅝" S.C. HOLDERS.
Heavy C.G. ½" and ⅝" S.C. ditto.
Conduit ¾" and ⅝" S.C. ditto.
Extra Heavy S.C. BATTEN HOLDERS.
Heavy S.C. BATTEN HOLDERS.
5 and 10-amp. Hardwood 2-pin PLUGS & SOCKETS.
5 and 10-amp. Handshield ditto.
5 and 10-amp. All-china ditto.
5 and 10-amp. 2-pin FLUSH PLUGS, with heavy Brass Flange and China Plugs.
Black Composition ADAPTORS.
Rosewood and Walnut ditto.
China loose-pin ditto.
Miniature Cocus ditto.
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Cream China, 2-plate CEILING ROSES.
White China, 2-plate ditto.
Cream China COUNTERWEIGHT SETS complete.
2-way Hardwood PEAR SWITCHES.
1-way All-Brass ditto.
5 and 10-amp. P.B. SWITCHES on Cream Base.
5-amp. Flat Type combined SWITCHES & PLUGS.
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1-wire Bell Cleats.
1⅝" 2 and 3-wire CLEATS.
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Casters in Ferrous and Non-Ferrous Alloys,
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Manufacturers of

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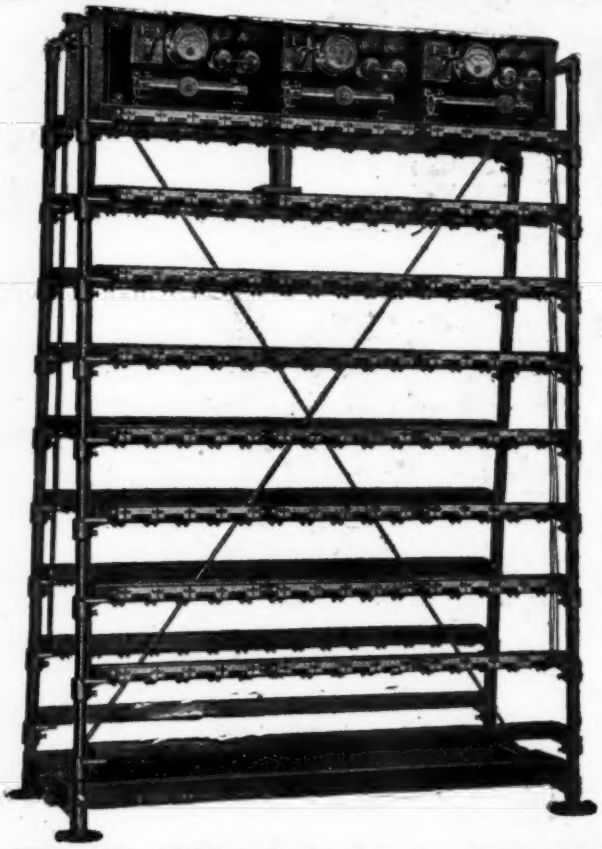

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FOR MINERS' LAMPS.

TO SUIT EVERY KIND OF LAMP.

YOU SHOULD SPECIFY YOUR STANDS
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WE HAVE A REPUTATION AMONGST THE LAMP MAKERS FOR EXCEPTIONAL QUALITY.

EVERY DETAIL MADE AT OUR WALSALL WORKS, INCLUDING METERS, AUTOMATIC CUT-OUTS, REGULATING RESISTANCES, &c.

IF OTHER MAKES ARE PRESSED ON YOU, SEND US YOUR ENQUIRIES DIRECT.

THE WALSALL ELECTRICAL CO., LTD.,

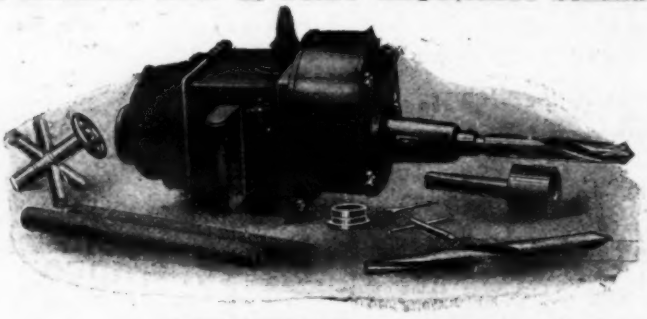
57, Bridge Street, WALSALL.

"WOLF" ELECTRIC TOOLS.

The Machine with 18 Years' Experience behind it.

We build all types of Electrical Drills of capacities from ¼ in. to 2 in.

Every machine guaranteed for 12 months.



We also specialise in Portable Electric Grinding Machines.

Catalogue on Application.

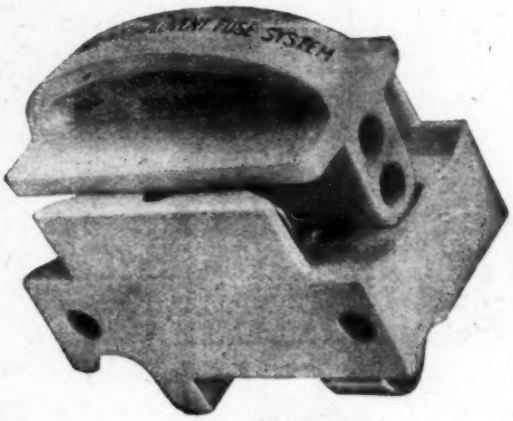
M. Type. Capacities, ⅜ in., ⅝ in. and 1¼ in.

S. WOLF & CO., LTD. (The Pioneers of the Electrical Tool Industry), **115, Southwark Street, LONDON, S.E.1**

Telephone Nos.:—5173 Central, 2784 Hop. Telegrams:—"Widerstand, London."

"Designed for Large Currents"

on principles which power consumers readily endorse, and proved by exceptional tests to stand up to the severest short circuits—



HOPE'S PATENT.

Fluvent

REGD. TRADE MARK

15/300 Amps. FUSE

differs only from our standard FLUVENT Fuse in that it is built on a larger scale, having two main vertical tubes instead of one as on the former, so that when the fuse blows under heavy conditions the stress thus set up is distributed equally over the carrier.

Each part is accurately made to gauge—hence perfect contact of bridge with base is always secured; no portion of the actual fuse wire is in direct contact with the china at any point; its tubular fuse chamber has indestructible lining and will withstand 3000° C.; and the fuse has a perfect inverse time element.

It has our customary table printed at foot, giving details for wiring at any rating desired between 15 to 300 amps.

The FLUVENT Fuse is made in three sizes, and many other special advantages are fully explained in our Catalogue, free on request.

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London Office: 25, Victoria Street, S.W. 1. Scotland: David Alexander, Mains St., Waterloo St., Glasgow.
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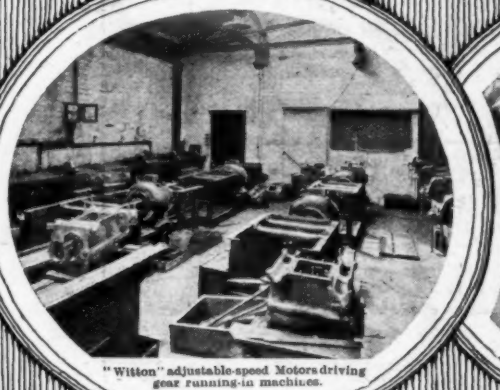
G.E.C.

"Witton" Motors driving slotters, drills, &c., in Aero Engine Works.

"Witton" Motors, starting Aero Engines on test.



"Witton" adjustable-speed Motors driving gear running-in machines.

"Witton" Motors driving grouped machine tools in Aero Engine Works.

"Witton" Motors, driving lathes in Aero Engine Works.

"Witton" Motors, driving turning section in Aero Engine Works.

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G.E.C.

Industrial Electrification.

No. 19.—AEROPLANE FACTORIES.

THE production of aircraft in the enormous quantities which are now being manufactured has only been possible by the utilisation of complete electrically driven machine shops, and with a wealth of experience behind them in the electrification of the motor-car industry, the industrial electrical engineers of the General Electric Co. have been able to apply their knowledge to the aeroplane industry, with the result that the very large aircraft factories of which they have undertaken the electrification have been rapidly set to work with a maximum rate of production.

Aircraft factory electrification requires plant, not only for driving groups of machine tools, but for such special purposes as starting aeroplane engines on test, and for other work which it is not permissible to mention, as well as for minor duties such as testing aero engine lubricating systems. The selection of the most suitable size of motors for the group drives, the lighting of the shop to secure the best results, and kindred problems, are matters on which the Company's engineers are well worth consulting.

The experience of the Company's industrial electrical engineers is at the disposal of Aeroplane Factory engineers and managers, and of supply authorities having Aeroplane Factories within their supply area, and they are invited to consult the G.E.C. regarding any extensions contemplated either immediately or in the future.

Next Week - - - - PILGER WORKS.

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Head Office: Queen Victoria Street, London, E.C. 4.

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Liverpool—Church Alley.
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Sheffield—Angel Street.
Glasgow—Waterloo Street.
Cardiff—Womanby Street.

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Bristol—Victoria Street.
Swansea—Wind Street.
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The heavy starting torque developed by all sizes of

Century

REPULSION START—INDUCTION

SINGLE-PHASE MOTORS

Illustrating a 2-H.P. Motor.

enables them to satisfactorily operate the great variety of equipments which, because of their design or purpose, require considerably more torque to start them than to keep them in motion.

ALL SIZES UP TO 40 HORSE-POWER.

25 TO 140 CYCLES.

Manufactured only by

CENTURY ELECTRIC COMPANY,

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A STOCK OF "CENTURY" MOTORS IS CARRIED IN LONDON BY—

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200

ACTUAL MANUFACTURERS.

TAPES, WEBS, SLEEVINGS,

For all classes of Electrical Work.

Large Stocks kept.

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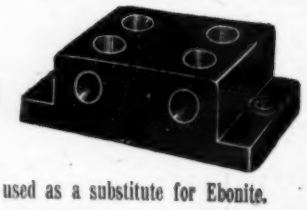

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THE ONLY SUCCESSFUL "TURN-DOWN" ATTACHMENT FOR ELECTRIC LIGHT.

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5 DIFFERENT CHANGES OF LIGHT!

SUPPLIED IN TWO TYPES: LOW VOLTAGE (80 to 130 V.) and HIGH VOLTAGE (200 to 250 V.).

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The electrical supplies that come from the B.T.H. factories give unfailing satisfaction to the consumer and promote confidence and goodwill between him and the contractor who supplies or instals them. Goodwill means Good Business—more business, and permanent business.

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The British Thomson-Houston Company, Limited,
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77, Upper Thames Street, London, E.C. 4.

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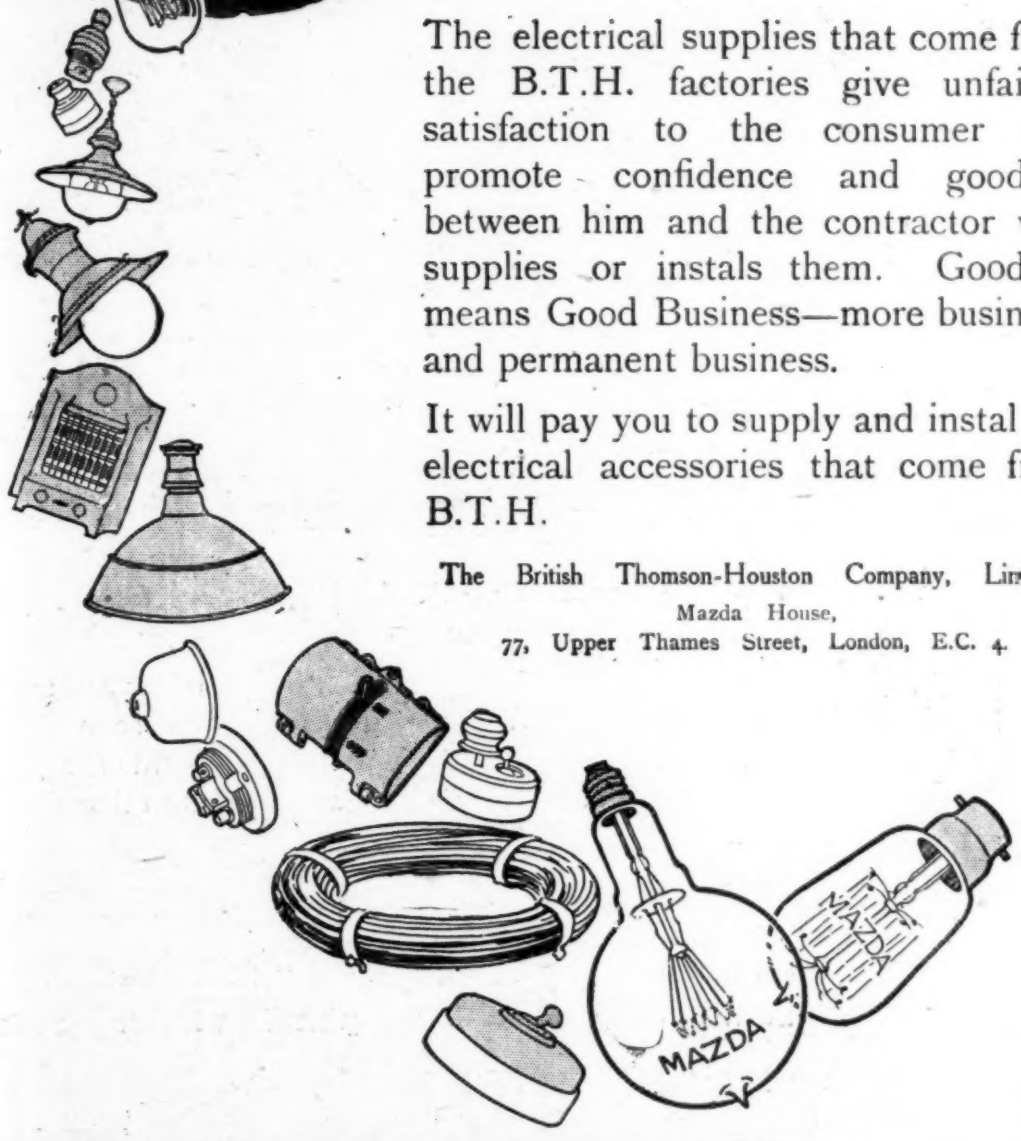

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Send us your enquiries for everything electrical you require.

If it's electrical—get it from B T-H

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The largest manufacturing works in Great Britain would, without organization, be chaos within a very short time.

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Our works are fully equipped and efficiently organized, and when once again we can deal with private enquiries will be at your disposal.

If you are interested kindly communicate with us.

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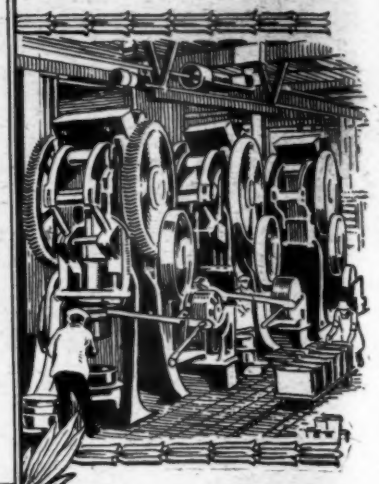
Kingsway House, Albion St., Birmingham.
London—Morley House, Holborn Viaduct, E.C. 1.



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The Controlling Hand *of the* Specialist

is seen in the remarkable efficiency of *every* machine constructed in our Works. They could not be so consistently good, they could not maintain so high a standard of excellence, if every machine produced in our Factories were other than the work of Specialists from A to Z.

As *Specialists* we have built up a world-wide reputation. As *Specialists* we solicit your enquiries with absolute confidence.

Mather & Platt, Ltd
Electrical and Hydraulic Engineers,
MANCHESTER and LONDON.

Your Orders should be placed with 'Specialists.'

This Lamp

is working for the contractor who installed it

—its brilliancy advertises him all the time the switch is on.

Its economy in current will advertise him every time the bill is paid.

Installed in the B.T.H. "Lumina" Fitting, which multiplies the illuminating efficiency, this Mazda Half-Watt Lamp is giving a light of surpassing brilliancy and of the quality of daylight.

The contractor who installed it rendered a service which the consumer will not forget.

Were you that Contractor?

We are Specialists in Good Lighting.
Lighting Advice and Plans Free.

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Branches:—Manchester, Birmingham, Leeds, Sheffield, Newcastle, Middlesbrough, Glasgow, Swansea, Cardiff & Dublin

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B.T.H.
"Lumina" Fitting
For Half-Watt Lamps

Mazda House is the Home of Reliable Wiring Accessories.

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We are Specialists in Good Lighting. We design and make Scientific Lighting Appliances and Fittings as well as the Lamps. Lighting Advice and Plans on request.

PORCELAINS

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SPARKING PLUGS;
Electric Heating and Cooking;
Lighting, Power Transmission, Telegraph, Telephone and Wireless Installations.

James Macintyre & Co., Ltd.
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JAMES HOWDEN & Co., Ld.,
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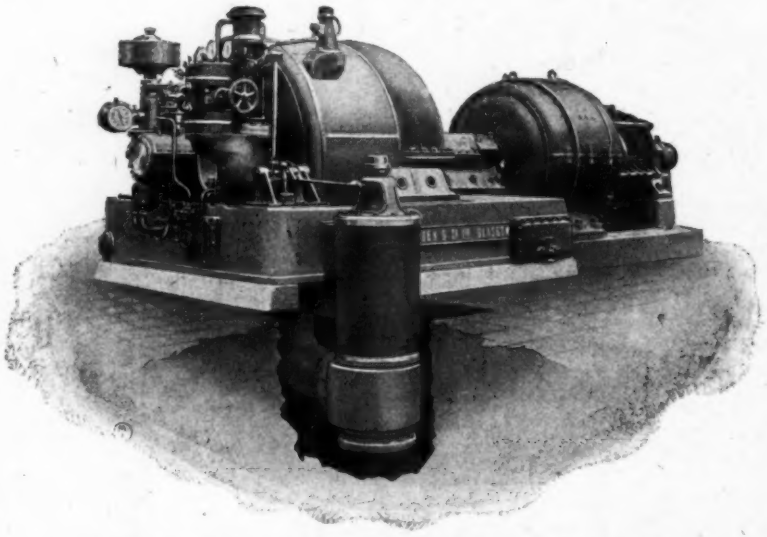
Patentees and Manufacturers of



750 KWT. "HOWDEN" MIXED PRESSURE TURBO-GENERATOR.
Installed at NOBEL'S EXPLOSIVES, Ltd., STEVENSTON, N.B.

HOWDEN'S Forced Draught.

WALLSEND-HOWDEN Oil Burning System.

Fans for Suction Draught, Ventilating, etc.

Patent Combination Water Tube Boilers,

Steam Turbines of the "IMPULSE" Type &

HIGH-SPEED STEAM ENGINES.

WHITE'S PATENT CONTROLLER FINGERS.

Telegrams: "Efficiency."

WITH REVERSIBLE AND RENEWABLE TIPS FOR ALL MAKES OF CONTROLLERS.

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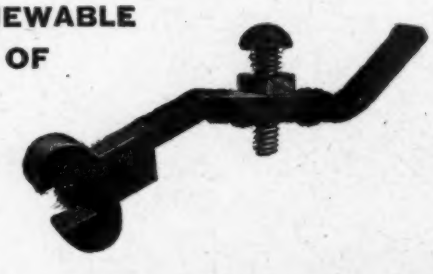
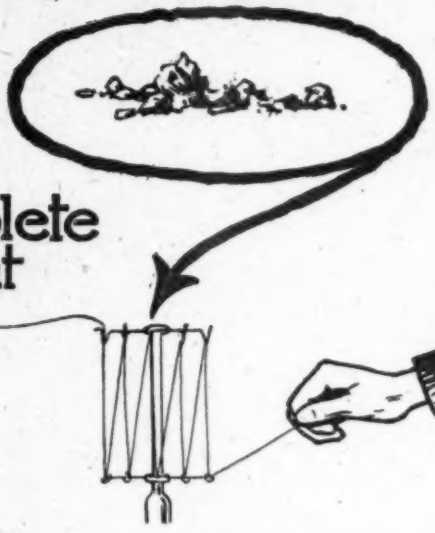


Illustration is about half size and represents Finger suitable for B.T.H. B18 Controllers.

SOLE MANUFACTURERS:

CLEVELAND METAL CO., Ld., *Bridge Works,* STOCKTON-ON-TEES.

From the Tungsten Ore—



to the complete wire filament

Process by process the work is carried out by British labour in our London Works. We do not buy the Tungsten Powder or the Tungsten Rod.

We begin with the Ore, refine and reduce it, work it into rod, swage it down, and finally draw down into the finest filaments.

We are Tungsten and Molybdenum experts.

See that your lamps are made with

"Pladuram" Wire

which is the only sure guarantee of a British product from start to finish.

Duram Ltd

Thanet House,
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INDUSTRIAL LIGHTING FITTINGS

For Shop, Factory, or Outside Lighting, Simplex Industrial Fittings are unequalled. If carefully installed better lighting at less cost can be effected than by any other method.

Catalogue No. 678 dealing with all types of Reflectors sent on request.

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10 & 11, Denmark Street, Bristol.
96, Whitechapel, Liverpool.
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4, Westgate Street, Cardiff.
1, Crimon Place, Aberdeen.
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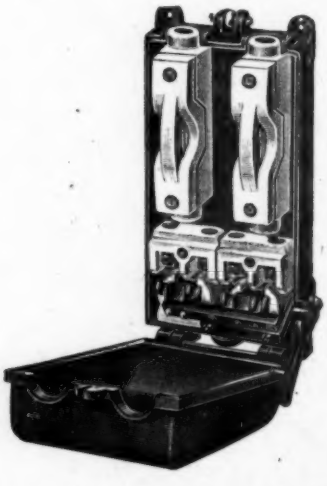
SIDE-HANDLE TYPE SWITCHES

WITH OR WITHOUT FUSES.

Designed to meet the requirements of the Factory Act Regulations.



ALL LIVE METAL SUNK into BEST QUALITY ENGLISH CHINA BASES.

Made in 3 sizes: 12, 30, and 50 Amps.

S. BILL & CO. 146, QUEEN'S ROAD, ASTON.

EBONITE

TONS

of **SHEET, ROD & TUBING** in London Stock in various Qualities and numerous Sizes.

EBONITE-VULCANITE, owing to its special nature, can only be made successfully after many years of experience.

We have been manufacturing this material for

OVER 60 YEARS!

Send us your Enquiries for:—

SHEET, ROD and TUBING
(War Office and Admiralty qualities stocked).

ALL descriptions of MOULDINGS.

ACCUMULATOR BOXES (Flexible & Hard).

SEPARATORS (Corrugated and Ribbed).

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Factories: Akron, Ohio. Butler, New Jersey. College Point, New York.

VULCANITE

Quality and Reliability DO Tell

ESPECIALLY with direct-coupled machines. For this reason among others we always welcome the opportunity for supplying Motors for coupled work, secure in the knowledge that the Parkinson Polyphase Motor is of standard quality and absolutely reliable.

The following illustration shows a team of five Parkinson Three-Phase Motors, direct coupled to centrifugal pumps. Many other examples of these Motors in similar work will be supplied on request.

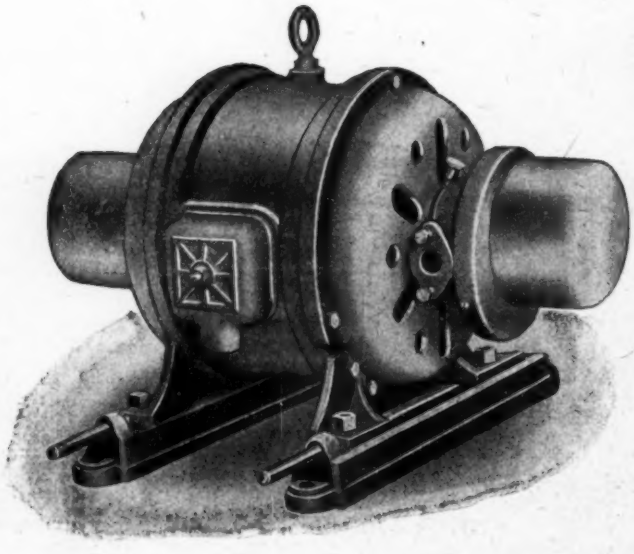
F. & A. PARKINSON LTD
GUISELEY
LEEDS
LONDON: 23, Victoria St. S.W.1.
PHONE-VICTORIA 3373

TWO FAMOUS BROOKS

Ye Brooke of Tennyson ~

which goes on and on for ever and hath a world-wide reputation—

and



E. BROOK, Ltd.

of

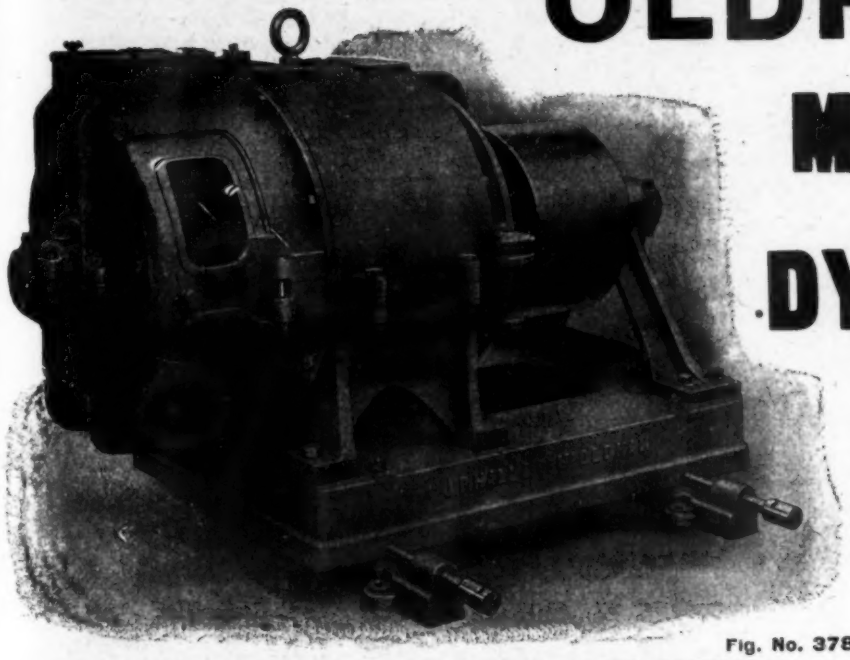
Huddersfield,

The Makers of the Motors with the world-wide reputation. . .

J. P. HALL & Co., LTD.

Telegrams: "DYNAMO," OLDHAM.
Telephone: 300 (two lines).

OLDHAM.



MOTORS AND DYNAMOS

FOR

Direct or Alternating Current.

♦♦♦♦♦♦♦♦♦♦

Fig. No. 378.
50-H.P. D.C. MOTOR WITH BEDPLATE AND OUTER BEARING.

THE

TAYLOR-SCOTSON PRESSURE REGULATOR

Highest Accuracy & Efficiency, Minimum of Attention, for

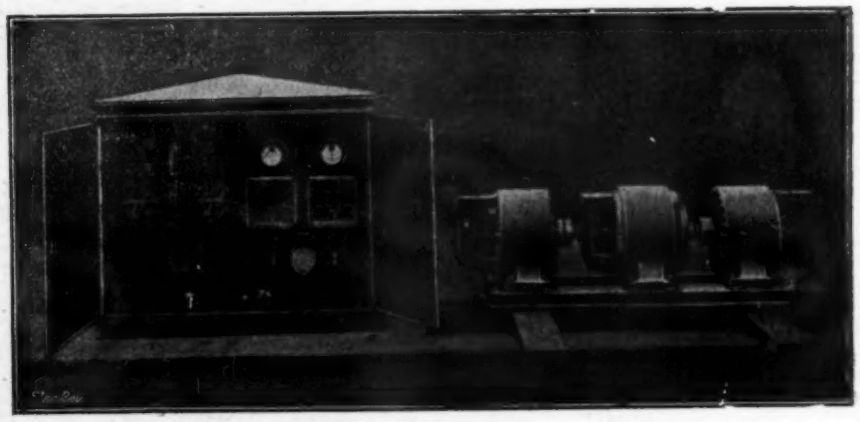
A.C. and D.C. POWER STATIONS

MAINTAINS CONSTANT VOLTAGE UNDER ANY NORMAL WORKING CONDITIONS.

Automatically Controlled Booster Sub-Stations

maintain constant pressure in outlying districts without increasing section of Feeders.

Saves COPPER and LABOUR.



Three-Wire Booster and Taylor-Scotson Regulator.

Sole Makers—

COX-WALKERS, LTD., Darlington.

Speed up

the production of your plant. One often finds, even in the best organised shops, that some jobs are not done quite as speedily as they might be. The importance of little things is sometimes overlooked, with the result that maintenance costs run up, and when they do production almost always suffers.

SUN PORTABLE ELECTRIC TOOLS

in the hands of your maintenance staffs will enable them to handle quite a lot of your repair work much more easily and quickly than was ever possible before. Wherever there is a light point available they can be used. Just read the brief particulars of the two tools illustrated, and you will immediately find a hundred and one uses for them in your shops.

PORTABLE ELECTRIC GRINDER.

(Top.)

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engineer have been instructed to attend the forthcoming meeting of the I.M.E.A. at Birmingham.

Fuel Economy.—In order to reduce the quantity of coal used for the production of electricity for the tramways, the Electricity Committee has instructed the engineer to experiment with the use of coke and coke breeze in place of coal.

Wallasey.—Price Increase.—The T.C. has increased the charges for electricity for lighting by ¼d. per unit, and for power, cooking, and heating by ¼d. per unit.

Walsall.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the Corporation of £4,000 and £2,304 for the purposes of the electricity undertaking.

Price Increase.—From the end of September the T.C. is increasing the charges of electricity for all purposes by a further 10 per cent.

Wolverhampton.—Year's Working.—The accounts of the electricity department for the year ended March 31st last show a deficit of £9,124. Fuel cost increased from £28,930 to £67,589, or from ·405d. to ·508d. per unit.

TRAMWAY AND RAILWAY NOTES.

Accrington.—Wages.—The T.C. has increased the wages of tramway conductresses by 5s. per week, making £2 10s. per week of 60 hours after one year's service.

Australia.—Melbourne Tramway Control.—It is proposed that the Melbourne tramways shall all be controlled by one body of 17 members, 15 to be elected by the ratepayers, 1 to be nominated by the Government, and a permanent chairman.

It is also proposed that the accumulated surplus on the cable tramways, amounting to about £827,000, shall form the nucleus of a sum for the liquidation of the indebtedness of the City of Melbourne to the State.

Brighton.—The B. of T. has extended the Brighton, Hove, and District Railless Traction Act, 1911, for one year.

Burnley.—Reduction of Service.—The Electricity Committee has considered the instructions of the B. of T. to reduce by 15 per cent. the consumption of coal for tramway purposes, and has notified the Tramway Committee that unless steps are taken within 14 days to arrange for such reduction, the electrical engineer will carry out the instructions as may be thought best.

Canada.—Wages.—The Winnipeg Electric Railroad Co. has refused to meet the demands of its employés for increased wages, on the ground that the additional burden would cause the bankruptcy of the company, and it is reported that the men will apply for a Conciliation Board.—*The Times.*

Continental.—Germany.—The regulations for the delivering up of metals by public bodies have been strengthened by new demands. Tramways and secondary railways have already given large quantities of metal, which has been removed from their carriages and overhead lines, to the Government. The encroachments on the line material have necessitated replacement by at least equal quantities of substitute metals, which were very difficult to obtain. Tramway companies are now making attempts to find means of putting still greater quantities of metal at the disposal of the Government, and it is probable that they will now remove the internal fittings of the cars, although they contain only a moderate quantity of the metals required.—*E.T.Z.*

Italy.—The Società Anonima Ferrovie Torino-Ciriè-Valle di Lanzo has increased its capital from 2,300,000 lire to 10,000,000 lire. for the purpose of electrifying the whole of its network within the period of one year.

Spain.—Application has been made to the Spanish Government for a concession to construct and work an electric tramway between Laviana and La Felguera (Province of Oviedo).

Ellesmere Port.—Proposed Light Railway.—The B. of T. has held an inquiry into the application of Messrs. Levenstein, Ltd., to construct a light railway at Hooton, in connection with their development scheme.

Keighley.—Railless Traction.—The Tramways Committee recommends an increase of tramway fares from an all-round level of 1d. to 1½d. The railless cars, it is stated, are a burden, largely owing to war conditions. During August 1st increased takings of £476 on the ordinary cars were almost counterbalanced by a decrease of £435 on the railless system. Out of the balance of £1,200 last year £762 was used to clear off a deficiency on the railless undertaking and £279 towards reducing the general debt on the undertaking, the balance of £170 being applied to reserve and renewals account, which had hitherto existed more or less in name only.

Lewis.—Proposed Electric Railway.—According to a correspondent, Lord Leverhulme is considering the construction, after the war, of 100 miles of electric railway on the Island of Lewis, which he owns. Power is to be obtained from the water of Loch Grimsharder.

London.—Wages.—At a meeting of men and women employés on the London underground railways on Sunday last, a resolution was passed protesting against the "shuffling tactics" of the Union officials and the Government in regard to the recent demands for equal pay for male and female labour, and also warning the Government that they would accept no other settlement than the levelling up of wages by giving the women 12s. 6d. per week war bonus. Another meeting to consider further action is to take place in a fortnight from the last meeting. According to the daily Press, the vice-president of the London District Council of the N.U.R. said that the brief strike was only a prelude to what was to come if the bonus was not granted, and next time the strike would spread to the Provinces. He said that "unless the bonus was granted, irrespective of what it might mean to the country, or to Tommy at the Front, or to the dividend-mongers, they would show that they had learnt to organise a strike on a big scale."

L.C.C.—Two tramway cars collided on Saturday evening, when a driver and a woman conductor were injured and had to be removed to hospital.

Rochdale.—Service Restrictions.—The T.C. has decided to suspend the Sunday morning tramway service, and to seek powers to increase fares. The question of reducing the week-day service is under consideration. As a result of arbitration awards there is an additional expenditure of £10,000 over last year on wages alone. The Tramways Committee has offered a bonus of 1s. 6d. to drivers when the consumption of energy per car-mile registered at the power station is reduced by 10 per cent.

Shipley.—Price Increase.—At the next meeting of the Bradford T.C. a proposal to advance the price paid to the Shipley U.D.C. for electricity for tramway purposes by 20 per cent. is to be put forward.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—A strike of 10,000 postal and telegraph workers at Buenos Ayres is reported.

China.—Owing to the great number of dialects in use in China, there is considerable difficulty experienced by "Central" in the use of the Chinese telephone. In an address recently delivered by Mr. Harry S. James before the Engineering Society of China, it was recommended, therefore, that the automatic telephone should be adopted in China as a possible solution of many of the problems encountered in the use of the manual telephone in cosmopolitan communities.—*Journal of Electricity.*

Russia.—It is stated by the daily Press that telegraphic communication with Western Siberia has been re-established.

CONTRACTS OPEN AND CLOSED.

OPEN.

Atherton.—September 16th. U.D.C. Two 110-kw. single-phase transformers. See "Official Notices" August 30th.

Bristol.—September 26th. Electricity Committee. Six months' supply unwashed small coal. Chief Engineer & Manager, The Exchange, Corn Street.

London.—Office of Works.—September 16th. Supply of electric bell fittings. See "Official Notices" September 6th.

Manchester.—September 13th. Corporation Electricity Committee. 3½-ton electric tipping wagon. See "Official Notices" August 23rd.

Spain.—Tenders have just been invited by the municipal authorities of Don Benito (Province of Badajoz) for the concession for the electric lighting of the town until the end of 1926.

South Africa.—October 23rd. Union of South Africa. Department of Posts and Telegraphs. Copper wire, &c., telephone apparatus (bells, blocks, boxes, coils, protectors, rosettes, switches, switchboards, &c). Tenders to Union Tender Board, Union Buildings, Pretoria. Specifications, &c., may be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

Stockton-on-Tees.—September 20th. Corporation District Fund, Gas and Electricity Committees. Stores for six months. See "Official Notices" to-day.

Warrington.—September 18th. Electrical goods for a year, for the B. of G. Mr. A. Bottomley, Clerk, Bewsey Chambers.

CLOSED.

Australia.—P.M.G.'s Department, Victoria :—
Fuses, &c., £711.—Western Electric Co. (Aust.), Ltd.

Department of Defence :—
Six 2-H.P. motors, £141.—Australian General Electric Co.

Department of the Navy :—
One Otis passenger lift with Australian made accessories, £1,172; one 2-ton goods lift (Otis), £1,302.—Standard Waygood Hercules, Ltd.

Commonwealth Ship Construction :—
Electric lighting installaton, £3,411.—Sutherland & Ashman.

Prime Minister's Department :—
926 telephone relays, £370.—Automatic Telephones (Aust.), Ltd.

Victorian Railways Department :—
Flexible tubing for power signalling, £112.—General Electric Co.
45 time element relays for power signals, £1,213.—General Railway Signal Company.

Victorian State Coal Mine :—
Waterproof sockets for E.S. lamps, 10d. each; insulated rubber tape, 5s. 9d. lb.—Australian General Electric Co.
—*Tenders.*

Burton-on-Trent.—Council Tramway depôt extension :—
Building work.—G. Hodges & Son, £1,519.
Ferro concrete work.—Lumbrick & Co., £603.

Glasgow.—Corporation Housing Committee. Tenders. Installation of electric lighting at Garngad Housing Scheme. Allan, Arthur & Ure.

Sheffield.—E.C. Tenders recommended :—
Two 25,000-kw. turbo-alternators, with Worthington-Simpson condensing plants.—C. A. Parsons & Co., Ltd.
16 boilers.—Stirling Boiler Co., Ltd.
A. Reyrolle & Co., Ltd.—Six panels, 3,300-volt, three-phase switchgear.
Brown Bayley's Steelworks, Ltd., John Brown & Co., Ltd., and Cammell, Laird & Co., Ltd.—300 tramway tires each.

Wakefield.—City Council. Electric wiring, &c., at the Maternity Home. Percy Parker, £104.

Walsall.—T.C. :—
Brush Electrical Engineering Co.—Annual supply consumers' transformers.
British Westinghouse Co.—Consumers' switchgear.
Walsall Electrical Co., Ltd.—Repairing electric wiring installation at Gas Works, £164.

FORTHCOMING EVENTS.

Institution of Mining Engineers.—Friday, September 13th. At 11.15 a.m. At University College, Nottingham. Presidential address.

Iron and Steel Institute.—Friday, September 13th. At 10 a.m. At the Institution of Civil Engineers, Great George Street, S.W. Autumn meeting.

Birmingham and District Electric Club.—Saturday, September 14th. At the Swan Hotel, Birmingham. At 7 p.m. Paper on "Graphs and Calculating Diagrams," by Mr. J. F. Avila.

Salford Technical and Engineering Association.—Saturday, September 14th. At 7 p.m. Lecture on "Steam Turbines," by Mr. E. Lee.

NOTES.

Separating Slate from Coal.—At a meeting of the Engineers' Club of Philadelphia, U.S.A., on April 2nd, a description was given of a new method of separating slate from coal. The invention is based upon the fact that if any relatively finely-divided insoluble material, such as sand, be mixed with a certain quantity of water, and if the mixture be continuously agitated, the mixture will exhibit the physical characteristics of a true liquid of high specific gravity. Such fluid masses can readily be produced by the use of seashore sand having specific gravities up to about 1·72. On putting a mixture of coal and slate into a fluid mass of this character, the slate at once sinks to the bottom, while the coal floats, the separation being complete. Apparatus embodying this principle, with conveyors to remove the coal and slate continuously, is under construction for experimental purposes. The inventor is Mr. T. M. Chance, of Philadelphia.

A Liverpool Electricians' Strike.—According to the Manchester *Daily Dispatch*, Liverpool electrical workers struck work last week on the non-Union question. "For some time the shop stewards in the Electrical Trades Union have been agitating in favour of compelling supervising engineers, foremen, and charge hands to join their craft Union, and in consequence members of the staffs of electrical undertakings have been approached lately with a view to their joining the E.T.U. In a number of instances in Liverpool supervisors and foremen have refused to join a Trade Union. The situation was discussed by the district executive of the Union on Tuesday night last week, but the rank and file took the matter into their own hands and decided to down tools at once." It is understood that later last week the number of men affected was increased to about 1,000.

A report in the *Daily Dispatch* on Monday stated that the Ministry of Munitions had intervened, and the Electrical Trades Union had been asked to send representatives to London that day to discuss the dispute. It was stated that there was every probability of a settlement being arrived at.

Proposed Swiss National Trade Mark.—In connection with our editorial comments of last week concerning German penetration, neutral productions, and the use that German agents would make of accommodating labels denoting falsely the origin of enemy manufactures, the following reference in the *Board of Trade Journal* to the proposed introduction of a Swiss Trade Mark may be studied with interest :—

"A copy of the Regulations under which it is proposed by Swiss Chambers of Commerce to establish a Swiss national trade mark under the name of S.P.E.S. (Syndicat pour l'Exportation Suisse) discloses the fact that the mark will be confined to firms two-thirds of whose capital is Swiss and to goods that are made in Switzerland exclusively by the Swiss. Thus any foreigners manufacturing in Switzerland will not be able to use this trade mark for goods manufactured by them in Switzerland. The object of the trade mark, it is stated, is not to place foreigners at a disadvantage, but to ensure that any articles bearing the mark SPES are to be really of Swiss manufacture. In addition, the mark is directed against German penetration, as numerous firms are known to be ostensibly Swiss, but in reality German. The President of the Geneva Chamber of Commerce states that the control of these will not be easy, but the Committee are alive to the probability of improper use of the mark, and they consider that it will be necessary for Swiss manufacturers to bring cases of this character to official notice. No foreign firms are to be prevented from manufacturing in Switzerland, but, not being Swiss, they are to be debarred from using the trade mark. With regard to the possibility of the extensive misuse of the trade mark by exporting merchants, it may be necessary to add the manufacturers' name to the trade mark. This may not be acceptable to exporters, and if impracticable and the trade mark fails as a result to protect Swiss manufacturers, it is considered probable that the Chambers of Commerce concerned will propose its abolition."

The City's National Kitchen.—The National Restaurant in New Bridge Street is not only a popular success, it is equally successful financially. Mr. C. F. Spencer, the Director of National Kitchens, has submitted to the Food Controller a statement on the working of the restaurant during the three weeks ending August 24th. For this period the weekly net profits were £50, £70, and £73. In each case provision was made for the full rent, management charges, reserve for renewals, interest at 5½ per cent. per annum on capital, and depreciation at 10 per cent. per annum. It was claimed by the catering trade that the restaurant could not pay with the quantity and quality of the food given and the cheap prices charged. The surplus of £70 a week, which appears to be maintainable profit, however, is equal, Mr. Spencer says, to 70 per cent. per annum on the capital outlay, and would be enough to repay the capital within 18 months; 17,925 persons took meals at the restaurant during the week ending August 24th; the average price of each meal was just under 6½d., and the cost slightly over 5½d., after making provision for all charges, and the net profit was ·986d., or nearly 1d. a meal. Further restaurants are to be established in London and the provinces.

Ministry of Munitions and Control of Electricity Supply.—The following regulation is now substituted for Regulation 11A under the Defence of the Realm Consolidation Act :—"11A. The Minister of Munitions, with a view to maintaining or increasing the supply of light, heat, or power for the purpose of the production, repair or transport of war material or any other work necessary for the successful prosecution of the war, may

(a) by order direct that lights of any specified class or description shall be extinguished, or their use restricted to such extent, between such hours, within such area, on such premises, and during such period, as may be specified in the order; or

(b) prohibit, restrict, or otherwise regulate and control the supply, or means of supply, of electricity to, or its use in, any premises or class of premises, or any place or undertaking,

and if any person having control of any light, or occupying or having control of, or managing, or being in charge of, premises in on or in connection with which any light is used acts in contravention of any such order as to lights, or if any person fails to comply with, or acts in contravention of, any order or requirement hereunder as to the supply, or means of supply, or use of electricity, he shall be guilty of a summary offence against these regulations :

"Provided that (i.) this regulation shall not apply to any lights required to be kept lighted by a competent naval or military authority, or other officer authorised by him for the purpose, or under any order made under Regulation 11 by the Secretary of State or the Secretary for Scotland; and (ii.) no order or requirement shall be made for the closing of any power station belonging to any local authority, or for the connection of any such power station with any other power station except with the concurrence of the appropriate Government Department, and if any question arises as to which Government Department is the appropriate Government Department, the question shall be finally determined by the Treasury."

Educational Notes.—University College, University of London.—The new session in the Faculty of Engineering begins on September 30th. We have received a copy of the prospectus, giving details of degree courses, &c., and scholarships offered.

Goldsmiths' College, University of London, New Cross, S.E.—Engineering Department.—The next session commences on Monday, September 23rd. Full particulars are given in our advertisement pages to-day.

London County Council Hackney Institute, Dalston Lane, E.C.—The new session commences on September 23rd. Particulars are given in our advertisement pages to-day.

Appointments Vacant.—Switchboard attendant for Southampton Electricity Works (51s. 10d.); attendants for Camp Hutment electric lighting installation; resident engineer for generating station in India (550 Rs. a month); assistant mains superintendent (60s. + 20s. + 12½ per cent.) for the Croydon Corporation Electricity Works; jointer wireman at Curragh Camp; second technical assistant (£250) for the County Borough of Newport Electricity and Tramways Department; switchboard attendant for the Battersea Corporation Electricity Department. See our advertisement pages to-day.

Municipal Tramways Conference.—The annual Conference of the Municipal Tramways Association is to be held at Leicester on September 26th and 27th.

Birmingham and District Electric Club.—The second half of the 1918 session opens to-morrow night, at 7 o'clock, at the Swan Hotel, New Street, Birmingham, with a paper by Mr. J. F. Avila on "Graphs and Calculating Diagrams." Later events for this year are:—

October 19th.—H. F. Steventon, "Some Modern Applications of the Gyroscope."
November 9th.—H. W. Dipple, "Automatic Telephones" (also visit to Dudley new Automatic Exchange).
November 23rd.—Ladies' Night. Lantern Lecture and Concert.
December 14th.—Annual Meeting.

Electric Vehicle Progress.—According to the Electric Vehicle Section of the N.E.L.A., New York, last month two New York ladies drove an "electric" a distance of 95 miles in one afternoon on one battery charge, using 200 ampere-hours. During the night the batteries were charged, and the following morning a distance of 77·5 miles was covered, using 170 ampere-hours. While resting, a matter of three hours, the batteries were boosted, leaving then for New York, a distance, with detour, of 80·9 miles, 200 ampere-hours being used. Over 253 miles were covered in a day and one-half of travel. The electrical energy used cost $2·50, or less than 1 cent per mile. This was not a "stunt" of a special car operated by a selected driver, but a trip made by a standard—and not new—car, driven by its owner, in this case a woman.

A demonstrating car, as manufactured by a Cleveland concern, recently travelled a distance of 78 miles on 172 ampere-hours in 3 hours 50 minutes. This route was over dirty roads and through very hilly country. Upon arrival there was considerable current left in the battery. On the return trip the distance covered was 100·8 miles on one charge; time, 6 hours 19 minutes; current used, 220 ampere-hours. The roads for the most part were hilly.

In South Africa the electric vehicle continues to make rapid headway, whereas little over five years ago the "electric" was virtually unknown. So rapidly and successfully did electric vehicle transportation development become in and about Johannesburg, that the local electricity supply company found it advisable to extend its activities, whereupon the service idea was introduced. Electric vehicles are sold without batteries from a general garage, which keeps batteries charged in readiness for any demand. Such, indeed, is the perfection of this system, that for $39.50 a month a car is not only kept in batteries, but is cleaned as occasion requires and maintained in repair.

In connection with energy costs, the following report of the Vice-Consul, Cape Town, will be interesting:—"Inquiries made in the principal cities of South Africa indicate that no restrictions have been placed on the use of electric energy for charging the batteries of motor vehicles save as to hours of doing so. In some cities certain regulations providing for higher charge per unit of current taken during peak load periods are in force; in others no energy at all is available for vehicles during such periods. In the city of Cape Town no restrictions are imposed regarding the use of electricity for propelling vehicles during any part of the day, providing always that the cables supplying the particular area where such energy is used are sufficiently large to carry the quantity demanded. The charge per unit of energy for such purpose is 1d. between the hours of 11 p.m. and 8 a.m., and 2½d. for the remainder of the day. Energy is also supplied at special rates where the consumer guarantees to use 100,000 or more units per annum. Such rates, however, depend on the quantity guaranteed and the conditions under which the energy is taken."

The demand for American-built electric vehicles by European countries continues to exceed the supply and available shipping facilities. Spain is the latest country to evidence a desire to utilise, on a large scale, electric vehicle transportation, not only for immediate use to help out in emergency conditions, but more particularly to form the basis of a systematic mobile transportation development to meet conditions which will obtain with the return of peace. To such end, several engineers, representing important Spanish interests, have been in the United States making investigations of electric vehicle developments there preliminary to effecting arrangements for the importation and manufacture of electric vehicles and parts. At this time gasolene, in Spain, costs about $2.00 per gallon, and consists of about 50 per cent. alcohol. Its use is not permitted by passenger-cars, and only very restricted quantities are available for commercial truck use, most of the fuel being reserved for Government transportation requirements. While this condition is abnormal, and likely to be relieved with the return of peace, yet, even then, the cost of gasolene in Spain will be likely to continue at a high figure. On the other hand, electricity, largely produced by water power, is at present available for charging electric vehicle batteries at 2 cents per KW.-hour.

Institution and Lecture Notes.—Institution of Electrical Engineers (Students' Section).—The Committee of this Section invites offers of papers from student members for reading before the Section during the forthcoming session, 1918-19. Full particulars of the papers, giving titles, probable date of reading, &c., should be sent as soon as possible to the Honorary Secretary of the Students' Section, Mr. R. L. Smith-Rose, B.Sc., 76, Maryon Road, Charlton, S.E. 7.

Company Fined.—According to the daily Press, a fine of £50, with 10 guineas costs, has been inflicted at Uxbridge on Bernard Wingfield (formerly Weisengrund), manager of the Power Plant Co., West Drayton, for breach of the Household Coal Order. He was accused of having made a false declaration as to the amount of coal he had in stock. For aiding and abetting him the Power Plant Co. was fined £5 and a further £5 for supplying industrial coal to its hostel.

Wanted, a Book!—Referring to our leaderette last week, a correspondent remarks that the A.C. book which we outlined is precisely the book he has been trying to procure for years, but has at last given up as unobtainable. He is by no means alone in his quest.

On the other hand, with reference to our remarks in passing on other books that were wanted, the Agricultural Electric Discharge Co., Ltd., of Gloucester, has sent us a copy of its brochure entitled "Increased Food Production," which has been published to show what has been and what can be done to increase food production by electric stimulation. The long-extended investigations of this company, under the supervision of Mr. Newman and with the advice of Sir Oliver Lodge, are familiar to our readers; but this publication certainly goes a long way to fill the gap in our literature on electroculture to which we incidentally drew attention. Naturally, it deals mainly with the company's own experiments, and the apparatus which it has developed for the purpose on a commercial basis, but it also gives summarised particulars of the scientific aspect of the subject, the results obtained by various experimenters, and the present position. We are interested to note that in a special experiment on 1 acre last year, designed to ascertain the effect of electrical stimulation after the wheat was "stooled"—that is, when the number of shoots from each root was fixed, and any increase in production would be confined to the number and size of grains—an increase of 33 per cent. was recorded, entirely due to increase in the size of the ears. The discharge was not applied until May 26th. In the ordinary case, when the stimulus is applied at an earlier stage, the number of ears is also increased, so that a gain of 50 to 60 per cent. should be regularly obtainable.

Electrified Wheat..—The results of the first two thrashings of electrified corn are announced by Mr. H. H. Dunn, seed specialist, of Salisbury. In the *Daily Mail* last July it was stated that over 2,000 acres were then under electrified seed.

The electrification consists of soaking the seed in a weak solution of common salt or calcium chloride, passing a comparatively small electric current through the grain in soak for a few hours, and then slowly drying it in a kiln.

Wheat grown at Fort St. Cleer, Liskeard, Cornwall, says Mr. Dunn, showed 28 per cent. increase on grain and 40 per cent. on straw. Oats grown at Moreton, near Dorchester, showed a gain of 61 per cent. on grain.

A Large Power Plant.—The Victoria Falls and Transvaal Power Co., which is said to be the largest power undertaking in the British Empire, was formed in 1906 with the object of supplying electrical energy to the gold mines and other consumers in the Witwatersrand area, excluding the Johannesburg municipality. In 1908 the largest group of mines now controlled by the Central Mining and Investment Corporation decided to electrify its mines and purchase all its power, both electric and compressed air, from the Rand Mines Power Supply Co., a subsidiary company of the Victoria Falls and Transvaal Power Co. There are, therefore, two separate power companies working under separate licences granted by the Government in terms of the Power Act passed in 1910, but both concerns are controlled and operated by the same management and staff. The capacity of the power stations installed is:—Rosherville, 64,000 H.P. (electric generators); Rosherville, 50,000 H.P. (air compressors); Simmerpan, 56,000 H.P. (electric generators); Brakpan, 40,000 H.P. (electric generators); Brakpan, 10,000 H.P. (air compressors); Vereeniging, 58,000 H.P. (electric generators); Robinson, 24,000 H.P. (electrically-driven compressors); total capacity of plant installed, 302,000 H.P. Approximately 837,000,000 units, or 1,120,000,000 H.P.-hours were sent out of the generating stations in 1917. This involved burning over 1,000,000 tons of coal, a large proportion of which consisted of duff, a by-product from the collieries. The total number of units sold for lighting, power, and tramways by the public utility companies and municipalities of Greater London for the year 1916 was about 450,000,000 units, or about 40 per cent. less than the units sold by the Victoria Falls and Transvaal Power Co. to the mining industry on the Witwatersrand. The compressed air supply is stated to be much the largest in the world. During 1917, 2,000,000 tons of air passed through the main pipe network from the two compressor stations to the mines for use in driving rock drills, &c. At the time of maximum load each day, air is delivered at the rate of about nine tons per minute.—*Iron and Coal Trades Review.*

Municipal Openings for Disabled Men.—Local War Pensions Committees have received from the Ministry of Pensions a communication in which their attention is directed to the local public services as affording suitable openings for disabled officers and men. Tramways and electricity supply are mentioned as follows:—

Tramways.—Managing and supervisory posts, drivers, conductors, foremen, yardmen, timekeepers, engineers, blacksmiths, carpenters, painters, and labourers.

Electricity Supply.—Managing and supervisory posts, collectors, engineers, enginemen, fitters and repairers, foremen, timekeepers, carpenters, painters, stokers, labourers, yardmen, &c.

The object of the Ministry is to secure such positions for these men as they afford a reasonable prospect of permanency. Their employment is, of course, subject to the reinstatement of former officials who may be away on war service.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Oxford Street, W. 1.

Corps Orders No. 38, by Lieut.-Colonel C. B. Clay, V.D.:—

Captain of the Week.—Capt. W. Hynam.

Next for Duty.—Capt. W. Darley Bentley.

Sunday, September 15th.—Commandant's Parade, at Waterloo Station, 8.45 a.m., for work at Esher. Dress: Drill Order, without rifles. Mid-day and tea rations to be carried.

Monday, September 16th, to Saturday, September 21st.—Drills as usual.

C. Higgins, *Capt.* R.E., *Adjutant.*

Greek Tour of British Industrial Centres.—The tour of Greek Commercial Delegates, which has been organised by the Federation of British Industries, commences on Sunday next, September 15th, with the arrival of the company at the Ritz Hotel in London. On Monday evening they will be entertained to dinner by the Government at the Carlton Hotel. Luncheon at the Mansion House on Tuesday will be followed by the Federation Dinner at the Ritz at night. On Wednesday the works of Callender's Cable and Construction Co., Ltd., at Erith, will be visited. On Thursday the Delegates will proceed to Birmingham, and there will be dinner and a reception at Queen's Hotel at night. On the following Friday, Saturday, and Monday various important manufactories in that city will be visited. Tuesday and Wednesday, September 24th and 25th, will be similarly spent at Nottingham and Lincoln, and after a brief stoppage at Derby on Thursday the journey will be continued to Liverpool, where the works of the United Alkali Co. (Widnes) and Lever Bros., Ltd. (Port Sunlight) will be visited on September 27th and 28th. In the following week two days (September 30th and October 1st) will be spent at Manchester (British Westinghouse Works, Crossley Motors, Ltd., and Ashton Bros. & Co., Ltd.). Later events in the programme are as follows:—October 2nd and 3rd, Sheffield (T. Firth and Sons, Ltd., J. Brown & Co., Ltd., Vickers, Ltd., Hadfields, Ltd.): October 4th, Bradford (Sir Titus Salt, Bart., Sons & Co., Ltd.); October 5th and 6th, Harrogate; October 7th and 8th, Leeds (J. Fowler & Co., Leeds, Ltd., and other works); October 9th, 10th, and 11th, Glasgow (N. British Locomotive Works Co., Carron Co., Beardmores, Stewarts & Lloyds, Ltd., and a trip on the Clyde); October 12th, visit to the Grand Fleet; October 14th, Edinburgh; October 15th and 16th, Newcastle and Middlesbrough (Armstrong Whitworths, Hawthorn Leslie's, Cargo Fleet Iron Co., Cochrane and Co., Dorman, Long & Co., Ltd.); October 17th, Saltburn-on-Sea; October 18th, Port Talbot (works visits); October 19th, Swansea (works visits); October 20th, 21st, and 22nd, Bristol and Bath (works visits). On Wednesday, October 23rd, the Delegates will return to London, where a Federation luncheon will be served, and the Association of Great Britain and Greece (Industry and Economics) will be formed.

The foregoing will show what a full programme has been arranged for the education of our visitors respecting British manufacturing capacity and activity in war-time. The Federation of British Industries has certainly resolved to leave nothing undone that shall ensure fitting hospitality for the guests in all the great centres that are to be visited. The Federation officials attached to the tour are Sir Chas. Dundas of Dundas, Mr. E. L. Hill, M.I.Mech.E., M.I.E.E., and Mr. H. W. Babington-Browne. The following are the names of the delegates:—

H. E. Mons. Michalocopoulos, Minister of Agriculture.
Mons. A. Skintzopoulos, Industrial Inspector of the Greek Ministry of National Economy.
Mons. B. Zamanos, Member of Parliament and Founder of the Vodena Cement Works.
Mons. L. Oeconomides, Chemical Manufacturer.
Mons. J. Damala, Finance and Banking.
Mons. A. Tsitis, Cotton Spinner.
Mons. C. Malikopoulos, Importer of Textiles.
Mons. E. Caralopoulos, Iron, Steel, Machinery, and Development Schemes.
Mons. M. Kazazes, Importer of Agricultural Machinery.

Batti-Wallahs' Society.—After a lapse of 18 months, 40 members of this Society held a lunch meeting recently, at the Holborn Restaurant, with Mr. L. M. Waterhouse in the chair. Owing to the success of the gathering, it was decided to hold a similar lunch meeting on Monday next, September 16th, with other like functions on the third Monday in succeeding months.

Electric Traction.—According to *Engineering*, Mr. G. M. Woods suggests a method by which he claims goods trains can be hauled electrically over the same tracks as electrically-propelled passenger trains, without increasing the load peaks beyond the limit which would be attained with the passenger service alone electrified. To this end he suggests that the goods hauled should be concentrated on the basis of light passenger traffic. In this way the load factor of the whole electric installation would be raised to a maximum, and the capital cost of the necessary equipment reduced to a minimum.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Aberdeen Tramways Committee recommends the appointment of Mr. W. Forbes, traffic superintendent and assistant manager, as general manager, in succession to Mr. R. S. Pilcher, who goes to Edinburgh.

Mr. H. Webber, borough electrical engineer and tramways manager, Keighley, has been appointed by the Controller of Coal Mines as district engineer to the Keighley district.

Mr. H. E. Munday, charge engineer at Cheltenham electricity works, has resigned, having taken up a similar appointment with the Bedford Corporation electricity department.

Mr. B. Hall, of Chatham, has been appointed as assistant to the Keighley borough electrical engineer and tramways manager, at £200 a year.

Mr. T. W. Hibbert, Barnsley, has been appointed station engineer under the Doncaster Corporation electricity department, at £200, rising after twelve months' service to £250.

Mr. Irvine Lynch has been appointed collector of accounts in the Rathmines (Dublin) Electrical Department, at £200 per annum.

The Pembroke (Dublin) Council has increased the salary of the electrical engineer, Mr. S. L. R. Price, from £450 to £500 per annum.

The Walsall Tramways Committee recommends raising the salary of the tramways manager to £600 per annum as from April 1st last, rising by two yearly instalments to £700 per annum. The salary of Mr. D. Mills, chief clerk in the electric supply department, is to be increased from £150 to £175 per annum.

Roll of Honour.—Lieutenant L. G. Byng, M.C., Grenadier Guards, to whose death from wounds on August 24th we referred in our last issue, was the second son of the late Mr. G. Byng, founder, and until 1910, chairman, of the General Electric Co., Ltd., and Mrs. Byng, of 32, Bryanston Square. Lieut. Byng was born in 1888, and educated at Harrow. On leaving school he joined the General Electric Co., Ltd., of which company he became a director in 1910. In 1914, he joined the Inns of Court O.T.C. He received a commission in the Royal West Kent Regiment, but finally transferred to the Grenadier Guards, and had served with them in France since July, 1917. He fought in several battles this year, and gained the Military Cross under the following circumstances:—

When information was urgently required as to the enemy's position and movements, he went forward 600 yds. into "No Man's Land," and, although he passed many large parties of the enemy who were crossing his line of advance, he succeeded in penetrating into the enemy's main position. He remained there observing for over six hours, and returned with a prisoner and much valuable information. He showed splendid initiative, enterprise, and determination.

He was wounded whilst leading his company in a most successful attack with, as his commanding officer wrote, "his accustomed gallantry." He died in the evening of the same day. Brother officers write that his chief characteristic was cheerfulness under all conditions. His cheeriness, his ready wit, his gentleness and modesty, made him quickly a favourite in all circles in which he moved, and he was welcomed everywhere. His charming personality will be equally missed by the board of directors, as by the members of the staff of the General Electric Co., in which it had been hoped he would play a part of great responsibility. As will be remembered, his younger brother, Harry, died in 1915 of wounds received at the battle of Festubert.

Private C. Moss, Northumberland Fusiliers, who has fallen in action, was formerly in the Leeds Corporation Electric Light Department.

Lieutenant H. W. F. Ponter, the Queen's (Royal West Surrey Regiment), attached K.R.R.C., aged 29, who, it is mentioned in the *Times*, was killed while gallantly leading his men, had qualified as an electrical engineer, and, after serving his articles with a Bristol firm, he obtained appointments at Rugby and Manchester, and afterwards with the Metropolitan Railway.

Bombardier R. H. Sanderson, who was on the Carlisle Corporation electricity works staff, has been killed on his way to rejoin his battery at the end of his wedding furlough. He had gained the Serbian Gold Medal.

Mr. S. Crosby, senior Marconi officer on board a vessel sunk by enemy action, is a prisoner of war in Germany.

Lieutenant E. Morton, who has died of wounds, was formerly a premium pupil at the Whitehaven Corporation electricity works, and was later engaged on the Mersey Underground Railway.

Lieutenant F. H. Andrews, M.C., M.M., Gloucestershire Regiment, who has fallen in action, was in civil life engaged with Messrs. Lea, Son & Co., electrical engineers, of Shrewsbury. He gained the Military Medal and later the Military Cross.

Private A. Capper, South Lancashire Regiment, missing since November last, and now reported killed, was employed by Messrs. Connolly Bros.

Private C. Charlott, South Lancashire Regiment, reported

killed after being missing since last year, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Flight Cadet J. E. Denton, R.A.F., eldest son of Mr. E. Denton, electrical engineer to the Pudsey Corporation, aged 18 years, met his death by accident whilst practising flying in a Yorkshire training ground last week.

Private J. S. Graham, formerly an electrician with Messrs. D. Colville & Sons, Clydebridge Steel Works, Cambuslang, has been killed in action.

Lieutenant-Colonel C. F. Rundall, who, after being superintendent of the Brennan Torpedo Factory, was in 1913 appointed chief instructor at the School of Electric Lighting, has been wounded in action. For his services during the war, Colonel Rundall has been mentioned in despatches on several occasions, and has been made a Companion of the Distinguished Service Order.

Seaman W. Whyte, formerly employed by Messrs. Haddow and Co., electricians, Glasgow, has been killed by his ship striking an enemy mine on August 2nd.

Private J. Hislop, who was formerly employed at the Langside depot of the Glasgow Corporation tramways, is officially reported killed in action.

Second-Lieutenant W. H. McCallum, formerly on the staff of the telephone department at the G.P.O., Glasgow, has been killed in action.

Private F. Temple, Grenadier Guards, a Cardiff tramwayman, has been presented by the staff of the Cardiff tramways department with a gold watch, chain, and pendant, in recognition of his winning the Military Medal. Mr. Arthur Ellis presided over the proceedings, and was supported by Mr. H. David (the traffic superintendent).

Private H. Daintith, Royal Fusiliers, killed in action, was employed by the St. Helens Cable & Rubber Co., Ltd., Warrington. Private D. Bradshaw, South Lancashire Regiment, officially reported to have died from wounds, was also an employé of the same company.

Private W. U. Priestley, London Regiment, wounded and in hospital at Huddersfield, was employed at the Blackpool Corporation electricity works.

Major F. A. Robinson, M.C., Tank Corps, formerly in the electric light department of the India-Rubber Co., Silvertown, and Driver J. P. Crosley, R.F.A., and Private H. F. Payne, East Yorks. Regiment, who were in the general office of the same company, have all been wounded in France, Driver Crosley seriously. Private W. F. Day, Machine Gun Corps, late of the electric light department of the company, died in hospital on August 13th after being gassed.

Obituary.—Sir Ratan Tata.—The death has occurred at the age of 47 years of Sir Ratan Tata, of Twickenham, who with his elder brother, Sir Dorab Tata, had much to do with the carrying out of the Tata Hydro-Electric Works from which Bombay receives power supply, a scheme the conception of which was due to their father, the late Mr. Jamsetjee N. Tata.

Wills.—Mr. R. W. Hornsby, of Grantham, left £159,873 gross, and £147,448 net personalty.

Mr. W. Booth, chairman of J. Booth Bros., Ltd., crane makers, Rodley, left £26,529.

A NEW LIGHTNING ARRESTER.*

The electrolytic lightning arrester is, as a rule, remarkably effective, but under sustained conditions supplementary protection may be employed to advantage. For the protection of the arrester under these conditions Mr. E. O. Schweitzer has conducted preliminary experiments on a device of his own invention, which is designed to open and close, or vary the resistance of the arrester circuit automatically at any time when it is in danger. The possible use of the electrothermal valve, as this device is termed, as a complete lightning arrester, entirely obviating the use of an arrester of the ordinary type, is indicated by the experimental data. A series spark gap is here required, as for other arresters. The electrothermal valve is shown in figs. 1 and 3; it consists of a vertical cylindrical chamber made of a bakelite tube (5) closed at the ends by cast-iron caps. The upper adjustable electrode (4) is of artificial graphite in the shape of an inverted four-sided pyramid supported by a steel rod (1), through which it makes electrical connection with the high-potential circuit to be protected. This rod passes through the stuffing-box (2) in the upper cap, in which it can be moved, when desired, to vary the distance between the electrodes. The lower electrode (6) is a flat plate of artificial graphite, permanently attached to the lower cap, which is earthed. So far ordinary city water has been used as the electrolyte. The chamber is provided with a small relief valve (3), and is also connected by a pipe to a reservoir by means of which a certain desired pressure is maintained in it.

The heat generated by the flow of current following a discharge through the electrolyte produces a pressure in the electrolytic chamber. This pressure is only partly relieved by the small valve, and in the meanwhile the resistance of the electrolyte decreases as its temperature rises, so that the current increases rapidly. Then the area of contact between the electrode and the electrolyte becomes less and less as the electrolye level falls, since the electrode tapers to a point. The decreasing area of contact results in an increasing contact resistance, and the current drops rapidly, although smoothly. Despite the decrease in current, heat is now being generated at a high rate at the contact surface, and the electrolyte is forced rapidly downward until contact is broken at the point of the electrode and the current becomes zero.

The needle valve now relieves the pressure, and if the impressed voltage has been removed the electrolyte will return rapidly to its original level. If, on the other hand, the impressed voltage has been maintained at its full value, the electrolyte rises only to a point where it makes contact with the tip of the electrode. This contact is so small and of such high resistance that the production of heat is exceedingly rapid, the pressure quickly rises, the electrolyte is immediately forced down out of contact with the electrode, and

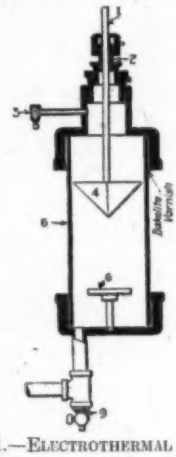

Fig. 1.—Electrothermal Valve.

the flow of current is but momentary. This last cycle is repeated over and over again so long as the impressed voltage is maintained, resulting in a momentary flow of current at brief intervals.

The higher the impressed voltage, the more rapid the operation of the valve, since a high voltage results in a large flow of current and a rapid generation of heat. If the impressed voltage is sufficiently low, a small flow of current may continue indefinitely without causing the valve to function. Other conditions remaining constant, the distance between electrodes governs the electrical resistance of the valve, and thus the magnitude of current flow. If the distance is short, the current flow will be large and the operation of the valve rapid. As the distance is increased the time required to open the circuit becomes greater.

If the distance between electrodes is very short and the impressed voltage high, an arc might form and maintain it-

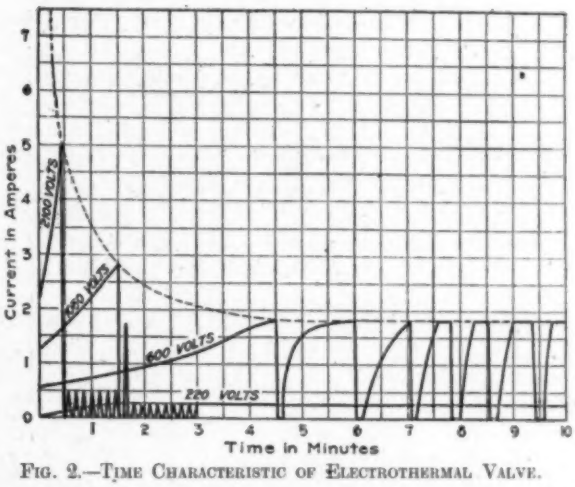

Fig. 2.—Time Characteristic of Electrothermal Valve.

self from the electrode after the electrolyte had been forced out of the way. This can happen only in case the normal voltage of the power line is sufficiently high to form an arc across the gap, since the duration of a disruptive discharge is too brief to cause such a result. The limiting electrode distances for different voltages have not yet been determined, and no such arc has ever formed during the course of the experiments.

The current-carrying capacity of the device may also be greatly increased by reducing its resistance. Increasing the cross-section of the electrolytic chamber, and at the same

* *Electrical World*, July 13th, 1918.

time increasing the size of the electrodes, will also increase the valve's current-carrying capacity.

Adjusting the needle valve to have a greater orifice decreases the speed of operation, since the needle valve then prevents the pressure from building up so rapidly as before, and when the circuit has once been opened the electrolyte will re-establish contact with the upper electrode in a shorter time than before, since the needle valve will release the accumulated pressure more rapidly. The needle valve must be set at the point which will give the desired balance between speed of initial operation and speed of return to initial position, and then be locked in place.

An approximate idea of the speed at which the electrothermal valve operates at different voltages and the current which it carries can be obtained from the curves shown in fig. 2. These show the experimental results obtained at 220 volts, 600 volts, 1,050 volts, and 2,200 volts, these voltages in each case being impressed directly across the electrodes without the use of limiting resistance of any kind. At the beginning of each run the valve was at room temperature, and the impressed voltage was maintained at its full value for 10 minutes. The electrode distance was 3 in. (7.62 cm.) in each case.

At 600 volts the current rose from an initial value of 0.55 amp. to 1.80 amp. in four minutes and 30 seconds. From the maximum the current dropped abruptly to zero in about two seconds. After remaining at zero for a few seconds the current began to rise again, at first rapidly, then more slowly, finally reaching a maximum at about the same value as before, whence it again dropped abruptly to zero. This cycle was repeated over and over again up to the end of the run, but each cycle was of briefer duration than the one before it. After the third cycle the current remained approximately constant at its maximum for several seconds. By this time the electrolyte was very hot and its resistance low, resulting in a tendency for the current to reach a higher maximum than before. This tendency was opposed by the fact that the pressure above the electrolyte also increased more rapidly than before. At the maximum value of the current these opposing tendencies exactly balanced each other for an appreciable time, thus holding the current constant.

The operation at 1,050 volts was quite different. Starting at an initial value of 1.25 amp., the current increased more rapidly than before to a maximum of 2.80 amp., which was reached in 1 minute and 30 seconds. The point of inflection in the curve is still noticeable, but less distinct than before, because the action is now more rapid. As before, the current dropped abruptly from its maximum to zero. After a brief interval it rose again—not to the former maximum this time, but to about 1.75 amp., dropping immediately to zero. Thereafter the current did not at any time exceed 0.25 amp., a value which it reached intermittently until the end of the 10-minute test, at periods varying from about five seconds at the beginning to about two or three seconds at the end.

At 2,100 volts the current rose very rapidly from an initial value of 2.2 amp. to a maximum of 5 amp., which it reached

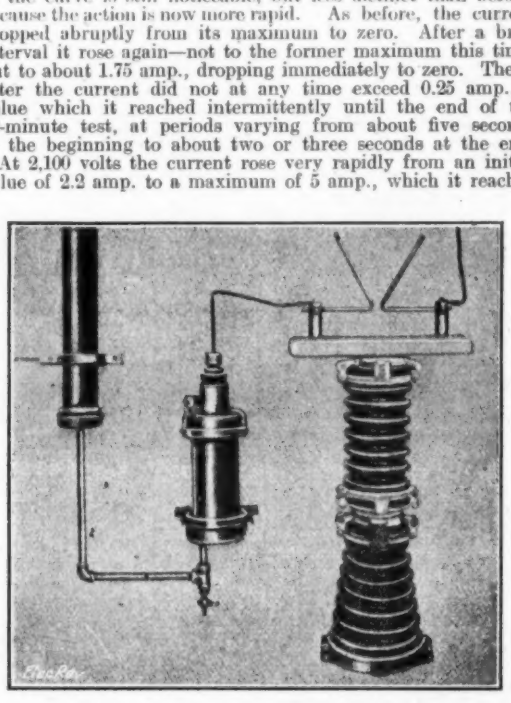

FIG. 3.—THE VALVE CONNECTED UP.

in 25 seconds. It then dropped abruptly to zero as before. This time the action was so rapid that no point of inflection can be observed in the ascending curve. After the circuit was first opened, at the end of 25 seconds, the current never again exceeded a value of about 0.5 amp. Up to the end of the 10-minute run the electrolyte made contact with the electrode tip at intervals of three to four seconds. At each contact there was a momentary flow of current, about 0.5 amp. in value, which dropped to zero again almost instantly. For the sake of simplicity, the curve sheet does not show these rapid alternations of current from zero to 0.5 amp. after the first minute, but they continued substantially as shown during the remaining nine minutes of the test.

The flash of the arc each time contact was made and instantly broken could be distinctly seen through the ¼-in. (3-mm.) bakelite-fibre wall of the electrolytic chamber.

The variation of electrical resistance during the four runs described, calculated from the observed values of voltage and current, was as follows:—

Impressed voltage.	Initial Resistance, Ohms.	Resistance of Maximum current, Ohms.
220	...	880
600	1,080	333
1,050	840	375
2,100	955	420

The resistance of the electrolyte itself decreases uniformly as the temperature increases, but the contact resistance between the electrolyte and the electrodes, always a considerable percentage of the total, and sometimes the governing factor, varies according to the impressed voltage and other conditions in a manner which is rather obscure, and does not lend itself to accurate prediction.

After some 20 or more separate runs had been made, the interior of the electrolytic chamber was inspected and found to be in perfect condition, despite the constant and rapid succession of high-voltage arcs which had been formed and broken during the tests. The upper electrode, which had acted as one terminal for these arcs, was as smooth and unpitted as it had been originally. The bakelite tube, the lower electrode, and the cast-iron caps all appeared to be in perfect condition. No test has yet been made to determine how adequately the electrothermal valve will take care of a disruptive discharge such as that caused by lightning. All tests so far made merely indicate how the valve will operate from the moment the power current begins to follow the disruptive discharge.

The device at present under test was built from guesswork. More information will be available when the tests are completed, and a larger unit can then be designed and constructed with some degree of precision.

It was foreseen that the electrolytic action between the electrodes would result in the decomposition of the water into hydrogen and oxygen, forming an explosive mixture above the surface of the electrolyte. To prevent the possibility of an explosion in the electrolytic chamber, which might occur when an arc forms at the moment the circuit is broken, the electrolyte was covered with a layer of transil oil. It is doubtful whether the oil is really necessary, as the quantity of gas formed during the brief flow of current must be small, and greatly diluted by a larger quantity of water vapour.

Although the electrothermal valve was originally proposed for use in series with an aluminium arrester, for the protection of the latter, it is apparent that it would be equally suitable for use as a self-contained lightning arrester. From the preliminary experiments so far completed it is evident that the valve possesses peculiar qualities which are advantageous in a lightning arrester.

NEW COMPANIES REGISTERED.

Weston Electrical Instrument Co., Ltd. (151,376).—Private company. Registered September 6th. Capital, £10,000 in £5 shares. Electrical and mechanical engineers, ironfounders, metal workers, &c. The subscribers (each with one share) are:—A. Davy, Audrey House, Ely Place, E.C. 1, electrical engineer; R. J. White, 5, Thavie's Inn, E.C. 1, solicitor. The first directors are to be appointed by the subscribers. Registered office: Audrey House, Ely Place, E.C. 1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Budenberg Gauge Co., Ltd.—Issue on August 22nd, 1918, of £3,200 debentures, part of a series of which particulars have already been filed.

Egham and Staines Electricity Co., Ltd.—Particulars of £17,000 debentures created by resolutions of September 25th, 1912, and June 3rd, 1918, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £5,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

W. S. Jeal & Co., Ltd.—Memorandum of satisfaction in full on August 16th, 1918, of debentures dated September 3rd, 1915, securing £400, has been filed.

CITY NOTES.

Kalgoorlie Electric Tramways, Ltd.

Presiding at the annual meeting held in London on September 5th, Mr. O. Wethered said that the position was about the same as when they last met. Conditions in Kalgoorlie were no better, nor could they be for some time to come. A great number of people who formerly used the cars now walked or used bicycles. The cost of all tramway requirements had greatly increased, indeed it was almost impossible to get them. Tires which cost under £2 each were now £5 10s. if imported, and nearly £8 if purchased locally. Copper wire could not be

obtained from England or America for Australia, but recently Japan had been supplying it. The arbitration proceedings respecting wages, &c., would cost the company about £1,200 per annum more. The operating expenses had been cut down to the lowest point, and they had been obliged to reconsider certain privileges that had been given to the public in the past. Workmen's tickets were to be advanced, and there was to be an extra 1d. on transfers from one section of the system to another. The manager, Mr. Stanley, was to be congratulated upon his handling of these matters, securing the changes mentioned without disturbing the friendly relations that existed between the company, the municipality, and the miners' unions. The returns for the first five months of 1918 showed an improvement of over £500. The Trans-Continental Railway was now running a bi-weekly service between Western Australia and the Eastern States. This should bring the company some benefit. The opening up of the vast area of land had great possibilities.

French Tramway Companies.

The report of the Compagnie Générale Parisienne de Tramways states that the passenger traffic and receipts increased in 1917, but the working expenses advanced in a greater proportion. Under the circumstances, the net profits receded from £48,000 in 1916 to £9,400 last year, which sum has been placed to the reserve fund.

The directors of the Compagnie des Tramways de l'Est Parisien report that the working of the tramways was becoming more onerous. The public authorities refused to grant compensation for the new burdens imposed on the company, and only offered interest-bearing loans repayable out of receipts in the years succeeding the war. If it had not been for the war contracts undertaken by the company, the directors would have been unable to meet the interest charges on the loans, but as these exceptional resources would stop with the cessation of hostilities, it was hoped that the local authorities would at last sanction an increase in the fares. The net profits realised in 1917 amounted to £16,000, as compared with £32,000 in the preceding year, which sums have been transferred to the renewal fund.

The Société des Tramways de Paris et du Département de la Seine, reporting on the year 1917, states that the Conseil d'Etat had established the principle of compensation for the greater cost of tramway working in certain cases, and the Ministry of Public Works had approved the raising of fares by several provincial tramway companies. So far, however, the same treatment had not been accorded to the tramways in Paris, but the precedents set imparted confidence in the result of the action instituted by the company before the Conseil de Préfecture. The gross profits earned in 1917 reached £21,000, as contrasted with £76,000 in the previous year. The financial and loan charges amounted to £67,000, which has been defrayed out of the gross profits, and the balance brought forward from 1916.

The Compagnie Générale Francaise de Tramways, which is financially interested in a number of French tramways, reports on the one hand an increase in the receipts earned by the various undertakings in 1917, and on the other an augmentation in the working expenses to a proportionately greater extent for the same reasons as those mentioned by other companies. It had been possible to obtain sanction to advance fares at Orleans, and the city authorities of Havre and Nancy had resolved thoroughly to examine the question, but Marseilles had declined, and legal action was contemplated in the matter. After meeting interest charges on and redemption of loans, the net profits in 1917 are returned at £122,000, of which £42,000 has been placed to the accident and renewal fund, and £80,000 allotted to the shareholders in the form of a dividend at the rate of 4 per cent. on the ordinary share capital of £2,000,000.

The Société Parisienne pour l'Industrie des Chemins de Fer et des Tramways Electriques, which is an investment undertaking, reports that the company continued to experience the effects of the war, which weighed all the more upon the company, as a large number of the concerns are situated in territory invaded by the enemy. The collapse of Russia had aggravated this situation, and although the directors were convinced that the prejudice was only temporary, they considered it prudent to devote the balance forward and the profits for 1917 to writing down the value of the undertakings. This depreciation applied on the one hand to the company's business in Russia, and on the other to the company's subsidiaries for African affairs, which were postponed through the war. The other companies in which the Société is interested were in practically the same position as in 1916, these including the Paris Metropolitan Railway, the Société d'Electricité de Paris, the Cairo Electric Railways Co., &c. The surplus for 1917 amounts to £132,000 on an ordinary share capital of £2,000,000, and after defraying general expenses and writing off £124,000, the balance of £2,900 has been carried forward.

The Compagnie Générale des Omnibus de Paris, which is principally a tramway company working in Paris, reports that notwithstanding a considerable increase in the receipts in 1917, the net profits did not permit of the payment of a dividend on the ordinary share capital of £3,320,000. The continued high cost of labour, fuel and of all raw materials, had absorbed the additional revenue yielded by the passenger traffic. All these causes were common to industries and trades, but whilst manufacturers and merchants recouped the additional expenses by raising their sale prices, the company's undertaking had still to charge the low fares which no longer corresponded to the services rendered. The city authorities, despite the suggestions made by the Ministry of Public Works, had refused to take effective measures in order to solve the difficulties which press on the tramway undertakings in the district of Paris, that is to say, to sanction higher fares or alleviate the expenses. Under the circumstances, the company had been compelled to proceed by legal action in order to obtain redress, and the directors had confidence in the result. Apart from the motor omnibuses requisitioned by the Army, the company possessed 581 motor cars and 348 trailers at the end of 1917, together with 208 vehicles of various kinds. As compared with the preceding year, the number of tramcar miles run decreased by 1.87 per cent., whereas the number of passengers carried increased by 9.96 per cent. It was estimated that the cost of electric power rose by 20 per cent. as contrasted with 1916, and that the total augmentation amounted to 175 per cent., as against the cost prevailing prior to the war. The total receipts from all sources were £1,469,000, and the total expenses were £1,208,000, leaving a balance of £261,000. After providing for the stamp tax on shares and debentures, and interest on the debenture issues of £3,840,000, and for the redemption of debentures, there remains a surplus and balance forward amounting to £25,000, which has been transferred to the next account.

Oxford Electric Co., Ltd.—Interim dividend of 5 per cent. per annum, less tax, on ordinary shares.

City of London Electric Lighting Co., Ltd.—Interim dividend of 6 per cent. per annum, less tax, on the ordinary shares.

County of London Electric Supply Co., Ltd.—Interim dividend of 5 per cent. per annum, less tax, on the ordinary shares.

Manila Electric Railroad & Lighting Corporation.—Dividend of 1¼ per cent. for the quarter to September 30th.

Globe Telegraph & Trust Co., Ltd.—Quarterly interim dividend on ordinary shares, 2s. per share, free of tax.

Shawinigan Water and Power Co.—Quarterly dividend of 1¾ per cent. (7 per cent. per annum).

Stock Exchange Notice.—The following have been ordered to be quoted in the Official List:—

Chile Telephone Co., Ltd.—Further issue of 22,000 shares of £5 each, fully paid (Nos. 66,001 to 88,000).

Calcutta Electric Supply Corporation, Ltd.—Units sold to consumers five weeks ended May 31st, 1918, 3,297,451, against 2,700,256 in 1917. Four weeks ended June 28th, 1918, 2,519,004, against 2,230,711 in 1917.

Eastern Telegraph Co., Ltd.—Second quarterly interim dividend of 1½ per cent. on the ordinary stock, free of income-tax.

STOCKS AND SHARES.

Tuesday Evening.

Markets round the Stock Exchange keep steady, and business in some sections shows a tendency to increase. At the same time, increased Labour unrest affords something of a check to financial enterprise. So far as illumination shares are concerned, the gravity of the position with regard to coal is arousing speculation as to how the companies are likely to be affected by the shortage that is now advertised so freely, and in the circumstances it is natural enough that there should be but little doing amongst electricity supply shares. This will affect the railways, of course, together with a hundred other important branches of daily life, and the announcement that the steam railway companies are considering a substantial curtailment in their services in the near future leads to the inference that the electric railways will also follow suit. Meanwhile, some are asking whether any measure of self-denial is to be laid upon theatres, music-halls, kinemas, and other amusement providers, where light is so lavishly used.

City of London Ordinary gave way ¼, but St. James's are similarly better. The feature in the electric list is the strength of lower-priced shares. London Electric Ordinary and Preference are both ¼ up. Edmundsons have risen sharply, the Ordinary to 6s., the Preference to 55s., while the 4½ per cent. First Mortgage Debenture stock is better at 73, the 6 per cent. Non-Cumulative Preference rather lagging behind at 15s. 9d., although there are no shares on offer. Urbans have hardened to 4s. and the Preference to 40s. The 4½ per cent. Debenture stock in this case stands at 71½. In the foreign list, Cordoba Light & Power Ordinary have risen to 3s. 3d. These seem to be very speculative. The preference also are better at 13s. The Mexican issues are good, Mexican Light & Power First Bonds gaining 6 points at 63, and Seconds being better at 44. Pachuca bonds remain at 48¼, and Monterey fives at 45½. Mexican Northern Power Bonds were taken on Monday at 18¼, and for almost anything with Mexico in its title there is more demand of the genuine order than has been witnessed for some time past. Calcutta Electrics are strong at 7½. The various Canadian issues are just steady, showing little variation one way or the other. Brazilian Tractions strengthened to 48½, and re-

acted to 47½, leaving them 1½ up on the week. Argentine issues are dullish.

Activity in Marconis is still the outstanding feature in the cable market. Lively dealings take place in the parent shares and in those of the subsidiary companies. Americans have risen to 30s. 3d., and Marconi Marines particularly are a strong spot at 65s. Marconis themselves show little variation. The market, however, is a good one, though it may be doubted whether there is not something of a weak bull account, so far as such a thing is practicable under existing Stock Exchange conditions. Still, those who are watching the market with a view to buying the shares may be able to get in more cheaply later on.

Chile Telephones are ¼ lower, while United River Plates are 1/16 up. Westerns have risen to 16¼ on the dividend announcement, and other stocks in the list keep firm. Telegraph Constructions are another 10s. to the good. On the other hand, Callenders at 11 have relapsed 10s., and small falls have occurred in Henley's, British Insulated, and British Aluminium, the reaction being natural enough considering the substantial rises that occurred in advance. Babcock and Wilcox further advanced to 4 1/16 to lose the 1/16 later on. The iron and steel market is hard as a whole, with a slight reaction in armaments following upon the extremely rapid rise which they enjoyed last week. India-Rubbers are ¼ up, the preference rose 5s. to 8, and the 5 per cent. debentures at 96½ show a gain of 3½ points. The last-named are due for repayment in 1926.

There is not much doing in the rubber share market, where the tendency remains uncertain, while amongst base-metal mining shares, the only outstanding feature is the strength of those connected with copper.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Sept. 10, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅝	—	£7 17 0
Charing Cross Ordinary	5	4	2¼	—	6 8 0
do. do. do. 4½ Pref.	4½	4½	3⅝	—	6 18 6
Chelsea	3	5	3½	—	7 13 10
City of London	8	8	11½	— ¼	7 0 8
do. do. 6 per cent. Pref.	6	6	9½	—	6 3 1
County of London	7	7	10¼	—	6 17 7
do. do. 6 per cent. Pref.	6	6	9⅛	—	6 1 6
Kensington Ordinary	6	7	5¼	—	6 17 7
London Electric	Nil	Nil	1½	+ ¼	Nil
do. do. 6 per cent. Pref.	4	5	3⅝	+ ¼	7 13 10
Metropolitan	3	4	3¼	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3⅝	—	6 18 6
St. James' and Pall Mall	8	9	6½	+ ¼	6 18 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	5¼	—	7 13 3
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	97½	—	6 3 0
do. Def.	1½	1½	23½	—	6 7 8
Chile Telephone	8	8	7⅜	— ¼	5 8 6
Cuba Sub. Ord.	7	7	10½	—	*6 16 7
Eastern Extension	8	8	15⅛	—	*5 3 3
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14⅜	—	*4 17 5
do. do. Pref.	6	6	10½	—	5 15 8
Great Northern Tel.	24	22	97½	—	5 17 4
Indo-European	13	—	57½	—	5 12 6
Marconi	15	20	4⅜	—	4 11 6
Oriental Telephone Ord.	10	10	3⅛	—	3 4 0
United R. Plate Tel.	8	8	7⅜	+ 1/16	*5 3 3
West India and Panama	6d.	1/3	1½	—	*3 12 0
Western Telegraph	8	8	16½	+ ¼	*4 17 0
Home Rails.					
Central London Ord. Assented	4	4	60¾	—	6 12 3
Metropolitan	1	1	26¼	— ¼	3 16 2
do. District	Nil	Nil	26	+ ⅛	Nil
Underground Electric Ordinary	Nil	Nil	2⅞	—	Nil
do. do. "A"	Nil	Nil	8/-	—	Nil
do. do. Income	6	4	84	—	*4 15 3
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅝xd	—	6 9 9
Anglo-Arg. Trams. First Pref.	5½	5½	3½	—	—
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	67	+1	7 9 3
Brazil Tractions	—	—	47½	+1½	—
Bombay Electric Pref.	6	6	10½	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	60¼	—	8 5 4
do. do. Preferred	Nil	Nil	42	—1	Nil
do. do. Deferred	Nil	Nil	96	—2	Nil
do. do. Deb.	4½	4½	60½	—	7 0 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	50	—	Nil
do. 6 per cent. Bonds	Nil	Nil	42	—	Nil
Mexican Light Common	Nil	Nil	29	—	Nil
do. Pref.	Nil	Nil	41½	—	Nil
do. 1st Bonds	Nil	Nil	68	+6	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	4	—	3 15 0
British Aluminium Ord.	10	10	2	— 1/16	5 0 0
British Insulated Ord.	20	20	2⅞	— 1/16	4 11 6
British Westinghouse Pref.	7½	7½	2⅜	—	5 9 1
Callenders	20	25	11	— ½	5 13 8
do. 5 Pref.	5	5	4½	—	5 17 8
Castner-Kellner	22	20	3¼	—	5 10 4
Edison-Swan, "A"	—	—	½	—	Nil
do. do. 4 per cent. Deb.	4	4	75	—	5 6 0
Electric Construction	7½	10	1⅜	—	7 5 6
Gen. Elec. Pref.	6	6	10⅜	+ ¼	6 5 4
do. Ord.	10	10	18½	—	*5 8 1
Henley	25	25	2 1/16	— 1/16	5 14 2
do. 4½ Pref.	4½	4½	4xd	—	5 12 6
India-Rubber	10	10	17½	+ ¼	*5 16 9
Telegraph Con.	20	20	47½	+10/-	*5 1 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 11th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£100	..
a Ammonia, Muriate (large crystal)	"	£77	£2 inc.
a Bisulphide of Carbon	"	..	..
a Borax	"	£43	..
a Copper Sulphate	"	£64	£1 dec.
a Potash, Chlorate	per lb.	2/4	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	£17 5/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£26	..
a " Lump	"	£25	..
a Soda, Chlorate	per lb.	1/1	..
a " Crystals	per ton	17d/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2' to 12' basis)	per lb.	..	..
c " Tubes (solid drawn)	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn)	"	1/8½ to 1/9	..
g " Bars (best selected)	per ton	£161	..
g " Sheet	"	£161	..
g " Rod	"	£161	..
d " (Electrolytic) Bars	"	£157	..
d " " Sheets	"	£161	..
d " " Wire Rods	"	£145	..
d " " H.C. Wire	per lb.	1/5½	..
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	3/8	5d. inc.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£37	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	6d. to 3/-	..
e " " " medium	"	3/6 to 6/-	..
e " " " large	"	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/10	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	5/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

New Type of Oscillograph.—A new oscillograph constructed by C. Heintze, Berlin, is remarkable for its simplicity in construction and working. The whole operation is automatic, and takes place on the throwing-over of a switch.

The device is arranged only for instantaneous exposure, and a gas-filled metal-filament lamp is provided as a source of light. When the controlling switch is operated, the photographic plate is released, and in falling short-circuits momentarily a resistance in series with the lamp, so that it glows very brightly for an instant. Furthermore, in its fall, the plate connects the movement of the oscillograph into circuit. The contacts are so arranged that the brightening-up of the lamp begins earlier and ends later than the time of entry and departure of the sensitive plate into the ray of light, and the oscillating motion begins and ends at moments chosen, so that a small section of the zero line is depicted at the beginning and end of the curve produced on the plate. When the switch is released, a controller flies back to its original position and cuts off the current from the whole apparatus, thus preventing the magnet coils and lamp from being left permanently in circuit. —*E.T.Z.*, July 11th.

Fuel Economy.—The Coal Controller has issued figures which show a serious falling-off in the estimated output of coal during the first 32 weeks of this year compared with the output during the corresponding period of last year. The net deficiency is nearly 13½ million tons, or about 8·7 per cent. In the four weeks ended August 17th there were 1,714,800 tons less than in the corresponding period of 1917. This diminution of supply occurs at a time when extra demands for many million tons of coal are being made for the American Expeditionary Force, for the urgent military requirements of France and Italy, for the British Navy, and for the manufacture of munitions; and also when stocks for industrial works, for public utility undertakings, and for household purposes are lower than ever.

An Order, entitled the Household Coal (Requisition) Order, 1918, has been made by the Board of Trade empowering local fuel overseers to commandeer trucks of coal consigned to private consumers that may arrive at stations, and to use the coal in the public interest.

THE DUTIES OF THE PROGRESS DEPARTMENT.

By W. J. HISCOX.

In view of the importance of the "Progress Department" in the organisation of a modern engineering works, it is hoped that the following series of articles, based on actual experience, will be of service to works managers.

The Drawing Office—The Tool-Drawing Office.

(*a*) *The Drawing Office.*—The receipt of the official order may be said to mark the commencement of the Progress Department's association with the contract, for the preliminary correspondence which led up to its acceptance does not constitute the first stage, although this correspondence may, upon receipt of the official order, be transferred from the Preliminary Correspondence File to the Works Order File. The order, upon receipt, is recorded, either in a book or upon a card, together with the section leader's name, and is then filed to await the receipt of the detail instructions. As a rule, it lies with the Drawing Office to issue these instructions, but the Progress Department is liable to press the Drawing Office in the event of any unnecessary delay.

The issue of the necessary drawings is of interest to the progress-man, for a perusal of these will familiarise him with the various details required in connection with the complete unit, and it is essential, therefore, that a blue print, or a reduced photograph of each drawing, is issued to the Progress Department at an early date, each drawing being marked with the order number of the job it is intended for, or, in the case of repetition work, with a description of the size and class of the apparatus. In the event of an order covering details for which drawings are already in existence, a drawing list should be issued by the Drawing Office. It would really be a good plan to issue a drawing list even in connection with a special class of manufacture, for this would enable the progress-man to check off the drawings as they are received, and so see at a glance exactly what drawings are outstanding at any time.

All drawings in connection with the order (or in connection with any complete section of the unit) should be in the shops before the issue of the specification or detail list, and the Drawing Office should co-operate with the Progress Department with a view to facilitating the issue of these drawings.

The specification list, which is really the shop order, is usually compiled by a specification clerk, and blue print, or type-written, copies are issued to every department interested, including a complete copy for the Progress Department. This list, which bears the order number of the job in question, contains all particulars of every detail required in connection with the order, including the quantity required, drawing number, material specification (with size and amount of bar required), source of supply, and a list of the departments through which the piece travels until it reaches its final stage. Every change from the original design is indicated by the issue of a revised, or an additional, specification list, and all suspension, release, and cancellation notices also emanate from the Drawing Office.

This sums up the connection of the Progress Department with the Drawing Office, and completes the first phase of the progress of the order; so from this we can turn to the duties of the Progress Department in connection with—

(*b*) *The Tool-drawing Office.*—This department, in many concerns, is a most exclusive and inaccessible department; but it is still one in which the progress man must actively interest himself. It is absolutely necessary that all tools, jigs, and fixings be ready at an early date, for nothing is more annoying to the management, and more calculated to upset delivery programmes, than belated knowledge of an uncompleted detail due to the fact that the necessary tools or jigs have not been made. It is imperative, therefore, that the progress-man gives due consideration to the early completion of these parts; and as they cannot be produced until the designs are in evidence, it is obvious that connections between the Progress Department and the Tool-drawing Office must be established.

An advance copy of the detail drawing should in all cases be issued to the Tool-drawing Office, to allow that department to determine what new tools, &c. (if any), are required, and the tool-drawing numbers should be entered on every copy of the detail drawing, showing for which detail each tool is required. Upon receipt of this information, the Progress Department should enter same on a progress sheet or a detail card, to enable it to be followed up, as circumstances demand. When a detail drawing is issued, and no new tools are required in connection with the same, a notice to this effect should be sent from the Tool-drawing Office, and a similar form could be used to notify the Progress Department when all the tool drawings for any specific detail are completed. Until such completion notice is received, therefore, the Progress Department has the responsibility of urging outstanding tool drawings, if these are at all likely to interfere with, or retard, the delivery of the detail for which they are required, and affect the delivery date of the complete unit.

It sometimes happens that the shop foreman has to order new or replace tools, a requisition covering the necessary particulars being sent to the Tool-drawing Office. It would be well for such requisitions to be made out in duplicate, and both copies sent by the foreman to the Progress Department. One copy would then be sent on to the Tool-drawing Office by the progress man, showing the degree of urgency of the tool required, and the other copy would be kept in the Progress Department until the necessary drawings are completed. If this procedure is adopted it will minimise to a great extent the large number of delays caused by the late completion of tools.

It has been mentioned that the Tool-drawing Office is an exclusive and an inaccessible department, and, without a doubt, the members of that department do resent the progress man's activities in their direction. The progress man has no desire to dictate to the draughtsman as to the length of time necessary for the completion of any specific drawing, any more than he desires to perform the same kind office for any of the shop foremen; but he has the same right to guard against any unnecessary delay in the Tool-drawing Office as in the shops. The draughtsman must realise that it is useless for the progress man to take every precaution to guard against delays in the shops, if the same precautions are not taken in those departments responsible for the preliminary work. It is not fair to penalise the shops for the delinquencies of the Tool-drawing Office, and to endeavour to force them to make good the delay occasioned by the late issue of the tool drawing. If the tool draughtsman does not desire the acquaintance of the progress man (professionally, of course) there is an obvious way of accomplishing this; but perhaps in a little while the Tool-drawing Office will become more democratic, and then the draughtsman will welcome the progress man as a fellow-worker, and not as an interfering inferior.

THE RATING OF MOTOR STARTERS.

By PERCY H. JACKSON.

Users of electrical starting apparatus will be well advised to become more conversant with standard ratings, a careful study of which will enable them to effect considerable economy.

Let us consider the rating of an ordinary duty D.C. motor-starter. The standard recommended, and since adopted by all reputable starter manufacturers, is as follows:—

The starting period of the motor, from rest to full speed, shall be 5 seconds, plus half a second for each 1 H.P. of the starter rating. For example, if the maximum rating of the starter is 50 H.P., then the starting period shall not exceed $5 + 50 \times 0{\cdot}5 = 30$ seconds.

It should be noted that the foregoing only refers to "ordinary" duty starters. For "heavy" duty starters the adopted rating allows a maximum starting period of 60 seconds. It is obvious, therefore, that if a 50-H.P. motor takes more than 30, but not more than 60 seconds to start, an ordinary duty starter will not suffice. Should the motor

take more than 60 seconds to start, a special starter must be installed. If burnt-out resistances are to be avoided, these figures must be borne in mind.

Just as important, however, is the consideration of the current value at starting. The foregoing ratings are based on the assumption that the starting current is equal to full-load running current, and prospective purchasers may economise by remembering this. It often happens that motors are started under light load, as when driving shafting provided with loose pulleys, in which event the starting current may be equal to only 50 per cent. of the full-load running current. Again assuming the motor to be of 50-H.P. capacity, a 25-H.P. starter will not only produce better starting and more even acceleration, but will be much cheaper. It will be appreciated that the "full-on" contact must be capable of carrying continuously the full-load current, but no difficulty will be experienced in this direction, for even though a special contact has to be fitted, the purchaser will still realise a saving of money.

For starters above 100-H.P. capacity it is of really great importance that the starting conditions be considered, because above this size a multiple-switch starter is usually recommended, the cost of which is much in excess of that of the face-plate type. A 200-H.P. motor, starting under 50 per cent. of full load, will be satisfactorily controlled by a face-plate starter with an interlocked short-circuiting switch to carry the full-load current. If starting conditions are not mentioned in the inquiry to the starter manufacturer, full-load starting will be assumed, with the result that much money will be wasted and the motor will be subjected to nasty kicks at starting caused by the low resistance and incorrect grading. The same remarks apply to all resistance starters, contactors, face-plate, or drum controllers.

Referring now to A.C. gear, the method of starting by means of a compensator or auto-transformer calls for similar consideration. Unfortunately, the rating of these starters is not yet standardised, with the result that different manufacturers have different ratings. The most suitable allows a starting period of 1½ minutes with a period of rest between each successive start equal to 10 times the starting period. The starter may, therefore, be used once every 16½ minutes. If the starting operation occupies 1 minute, then the rest period need be only 10 minutes. It often happens that the motor necessitates the starter being retained in the starting position from 1 to 1½ minutes; obviously then, a lighter-rated starter (and there are several makes rated for less than 1 minute) would soon burn out. Such experiences are annoying to all concerned, apart from the accompanying waste of time and money.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

THE following items are amongst the "Institution Notes" issued with No. 276 of the *Journal*:—

CERTIFIED OCCUPATIONS.

The secretary of the Institution has been informed by the Ministry of National Service that, as a temporary measure, instructions have been given to the Regional Officers of the Ministry not to call up for medical examination men of the new military age who are engaged in one of the occupations named below, provided they were engaged in the same occupation (not necessarily with the same employer) on or before August 15th, 1915:—

Electrical Engineering—

Foreman.
Turner; fitter; erector; electrician or other skilled workman.
Wireman.

RADIOGRAPHY JOINT COMMITTEE.

In collaboration with the British Association for Radiography and Physio-Therapy, the Council of the Institution has nominated the President (Mr. C. H. Wordingham), Mr. J. S. Highfield, Prof. T. Mather, and Mr. A. A. C. Swinton to serve on a Joint Committee of the two bodies, which has been appointed to prepare a scheme for ensuring that lay radiographers, &c., are properly qualified.

BOARD OF TRADE REPORTS ON ELECTRIC POWER SUPPLY AND ELECTRICAL TRADES AFTER THE WAR.

The Council has appointed a Committee to report on the above. The following bodies have been invited to nominate two representatives each, to serve on the Committee:—

Incorporated Municipal Electrical Association.
Association of Municipal Corporations.
Incorporated Association of Electric Power Companies.
Provincial Electric Supply Committee of the United Kingdom.
Conference of Chief Officials of the London Electric Supply Companies.
British Electrical and Allied Manufacturers' Association.
Cable-Makers' Association.
Tramways and Light Railways Association.
Municipal Tramways Association.
The Iron and Steel Institute.
British Electrical Federation.
Edmundsons' Electricity Corporation.
Federation of British Industries.

(The president and the four vice-presidents of the Institution are also members of the Committee.)

MAINTENANCE AGREEMENTS FOR SECONDARY BATTERIES.

The Committee appointed by the Council to report on the above consists of:—

	Nominated by
C. H. Wordingham, C.B.E. Sir William Slingo. R. T. Smith. F. W. Crawter. R. A. Chattock.	The Institution.
D. P. Dunne. E. Jacob.	The B.E.A.M.A.
(*One representative to be nominated*)	The I.M.E.A.
J. S. Highfield.	The Incorporated Association of Electric Power Companies.

LOCAL SECTIONS.

A Committee was appointed by the Council in March, 1918, to review the position of the Local Sections and to make suggestions as regards increasing their usefulness. The report of this Committee was recently considered by the Council, and as a result it has been agreed:—

(1) That the Local Sections be known in future as "Centres," their names being altered as follows:—

New Name.	*Present Name.*
North-Western Centre.	Manchester Local Section.
North-Midland "	Yorkshire " "
South-Midland "	Birmingham " "
North-Eastern "	Newcastle " "
Western "	Western " "
Scottish "	Scottish " "
Irish "	Dublin " "

The Irish Centre to include the whole of Ireland.

(2) To empower the Territorial Centre Committees to represent the Institution on other bodies, such as Chambers of Commerce, Technical Library Committees, Education Authorities, kindred Engineering Societies, and so forth, subject to the approval of the Council in each case.

(3) To delegate certain branches of research to some of the Territorial Centres by the formation of local Research Sub-Committees; such Sub-Committees to be appointed by the Council at the instance of the Territorial Centre Committees. It will be the duty of each Sub-Committee to report to the Research Committee and to keep the Territorial Centre Committee informed of the progress of the particular research.

(4) To invite other bodies to co-operate through their local Associations in regard to forming local Engineers' Clubs.

ENGINEERING TRAINING ORGANISATION.

The Council has sanctioned, on behalf of the Institution, a contribution of £250 towards the expenses of the above organisation for 1918.

COMMERCIAL ELECTRICAL DEVELOPMENT COMMITTEE.

The Committee appointed by the Council to consider the formation of an Electrical Cooking and Heating Association having completed its preliminary work, a new Committee, with the above title, has been formed.

The new body, which is a separate organisation independent of any institution or association, will immediately consider the question of the development of electrical cooking and heating.

BENEVOLENT FUND.

The report of the Committee of Management of the Benevolent Fund, adopted at the annual general meeting, stated that the total receipts in 1917 amounted to £430; the capital account stood at £4,612, and the accumulated unexpended income at £2,063. Fifteen applications for assistance were received, and the Committee made grants in 14 cases, amounting to £198. The capital account of the Wilde Benevolent Fund stood at £1,846, and the balance to the credit of the income account was £584. No grant was made from this fund.

MOTOR PROBLEMS.

At the end of our leading article on the above subject on August 23rd, we outlined the ideal motor controller in the following words:—"What is needed is the simplicity of the tramway controller—one operating handle only, capable of being moved forward as quickly as safe loading of the motor will permit, and backward as quickly or as slowly as the needs of the machinery require, and, above all, cheap and reliable."

The Igranic Electric Co., Ltd., have sent us illustrations and a description of a standard controller which, they claim, fulfils all the conditions that we laid down.

This controller, which is principally applied to electrically-driven machine tools, consists of two parts: (1) A self-acting panel, as fig. 1, and (2) a drum or tramway-type starting and speed-regulating switch, as fig. 2, and it is designed to control a variable-speed shunt-wound motor. The self-acting panel (fig. 1) consists of a number of clapper switches, mounted on a slate slab, which is supported on an iron box

Fig. 1.—Igranic Self-acting Panel.

containing the starting resistances. In addition, there is mounted on the slate slab one, or if needed two, vibrating relays. One of the clapper switches is used as a main switch to open and close the motor circuit, and the others, which are of the lock-out type, control the acceleration of the motor to normal speed by short-circuiting, in succession, the various sections of starting resistance in series with the armature. The acceleration of the motor above normal speed, by shunt field regulation, and deceleration by the same means, is taken care of by the vibrating relays in conjunction with the drum-type master switch (fig. 2). The function of the latter is to open and close the coil circuit of the main clapper switch, and to select the desired speed by the insertion of more or less resistance in the shunt field circuit. The master drum is the only piece that the machine attendant has to handle, and, being small, it can generally be mounted in a convenient position on the machine that it controls. Sometimes it is mounted at the base of the machine and operated by a movable hand-wheel which is geared to it, and so placed as to follow the tool. The self-acting panel can be mounted on any conveniently adjacent wall or pillar.

Taking our demands seriatim, the Igranic Co. remark:—

1. The starting, stopping, and speed regulating switch is, in form and construction, exactly like a tramway controller, with the additional advantage that it is small in size, and therefore easy to find a place for on the machine.

2. It has only one handle, by which every function of control is performed.

3. The handle may be moved either forward or backward as quickly as the operator likes without any untoward result. This is because the clapper switches, which control the acceleration of the motor to normal speed, are of the lock-out type, and automatically prevent too rapid short-circuiting of the starting resistances, while the vibrating relays automatically prevent too rapid insertion, or too rapid short-circuiting, of the field-regulating resistances.

Igranic lock-out switches have each two coils, one (called the closing coil) tending to close the switch, and the other (called the lock-out coil) tending to prevent it closing.

So long as the motor current exceeds a predetermined value the lock-out coil exerts a greater pull than the closing coil, and therefore prevents the switch from closing.

As soon as the current falls (through the acceleration of the motor) to the predetermined safe value, the closing coil becomes the stronger and closes the switch, thereby short-circuiting a section of the starting resistance.

When the switch closes, it short-circuits its own lock-out coil, and thereby prevents it any longer opposing the pull of the closing coil.

It will be seen that a series of such switches, used for the removal of starting resistance from the armature circuit of a motor, constitutes a self-governing, current-limit acceleration control.

One of the vibrating relays is called an accelerating relay, because its function is to prevent too rapid acceleration by field regulation.

Its operating winding is connected in series with the motor armature, and it is adapted, when the current passing through that winding exceeds a predetermined and adjustable value, to short-circuit the field regulating rheostat, thus restoring the motor-field to full strength.

As soon as the current passing through the motor armature falls to less than a predetermined value, this short-circuit around the field-regulating rheostat is removed and the resistance is reinserted, the result of such reinsertion being a tendency on the part of the motor to speed up rapidly and take more current from the line.

The increase in current through the operating winding causes the short-circuit to be re-established, and this relay continues alternately to short-circuit and re-insert the field resistance, vibrating in this manner until such time as the motor speed has been brought up to that for which the field adjusting rheostat is set.

The second vibrating relay is called a slow-down relay, and its function is to prevent the too rapid strengthening of the shunt field when reducing speed or stopping the motor. The action of this slow-down relay is quite similar to that of the accelerating relay, except that it must be arranged to insert

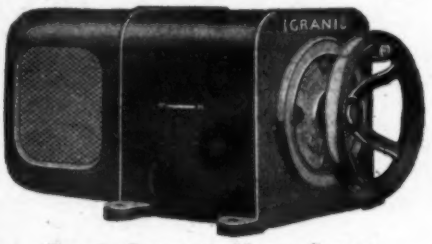

Fig. 2.—Drum-type Master Switch.

all field resistance on passage of an excessive current through its winding, instead of short-circuiting the field resistance, as the accelerating relay does. As the requirements for accelerating and slow-down relays are diametrically opposed, one being called upon to short-circuit the field resistance when the armature current exceeds a predetermined value, the other to insert it under the same conditions, it is obvious that the accelerating relay must be rendered inoperative when the motor is being slowed down, and, *vice versa*, the slowing-down relay must be rendered inoperative when the motor is being accelerated. This feature has been worked out in a thorough and effective manner, and interference between these devices is thoroughly guarded against.

4. Cheapness, the Igranic Co. remark, is a relative term, and a controller which effectually protects the motor from injury, as this one does, is surely cheaper than others which fail to do so, even if the latter could be purchased for only half as much. But the controller described is so simple in construction, and so few in its parts, that it can be produced at a price which is no obstacle to its sale.

5. Reliability is a question of experience, and the makers say they can point to numerous controllers of this type which have been in continual use for years in busy workshops and are still giving satisfaction.

Aluminium in Electric Machinery in Germany.—The Standardising Committee of the *Verband Deutscher Elektrotechniker* publishes modifications of its previous regulations concerning the use of aluminium in electric machinery. The previous regulations concerned machines, and they are now extended to transformers, for which the use of aluminium is now permitted, instead of zinc, that was previouly used as a substitute metal. The windings of transformers are generally made of aluminium, but copper may be used if the ratio of the power of the transformer in K.V.A. to the voltage of the windings in KV. does not exceed 0·5 for three-phase or 0·3 for single-phase currents. Brake magnets are to be wound with aluminium, and choking coils with iron cores are to be treated on the same lines as transformers. Choking coils without iron cores should generally be constructed of aluminium. In exceptional cases copper may be used for various parts of electrical machines—for instance, in the armatures of commutator machines destined for uses in which their temporary breakdown would endanger human life, or for very important installations, such as rolling mills, in which their failure would cause loss of material, in the armatures of commutator machines that are exposed to particularly violent variations of load, for machines in which the dissipation of heat is particularly difficult, such as in enclosed motors above 5 KW., and for machines in installations in which chemical action on aluminium is to be feared.—*E.T.Z.* July 4

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

ITALY.—The Commercial Treaties or Agreements between Italy and France, Brazil, Greece, Japan, Roumania, Serbia, Spain, and Switzerland, which were determined by the Italian Government last year (see the Electrical Review of October 19th), have been prolonged to the end of 1918, so that the "Conventional" Tariff rates of duty will remain in operation for that period.

NEW CALEDONIA.—By virtue of a Presidential Decree of December 23rd a duty of 3 per cent. *ad val.* is levied on the export of locally-produced ores, and 4 per cent. *ad val.* on the products of the treatment of such ores. The tax is collected by the Customs at the port of export.

PARAGUAY.—Under the Paraguayan Budget Law for the year ended June 30th, 1918, all goods other than those specially enumerated and duty-free goods are subject to an import duty of 42 per cent. Goods specially enumerated (other than those on the Free List) are subject either to percentage rates of duty (ranging from 9 per cent. in the case of iron, steel, and copper in sheets, bars and ingots, &c., to 89 per cent. in the case of spirits), or to specific rates of duty (the articles in this case consist almost entirely of foodstuffs). All dutiable merchandise is subject to an *additional* duty of 1½ per cent. The Law also specifies the taxes payable in respect of wharfage dues for imported goods, and the fees payable for storage charges for goods deposited in Customs warehouses. The text of the Law can be consulted at the Department of Overseas Trade (Development and Intelligence).

SOUTHERN RHODESIA.—According to recent official decisions, the import duty leviable on corning conahones (parts of electric or gas lamps, not hand), electric motor tire pumps, electromagnets (part of crane), and patent quarzarc electrodes is 3 per cent. *ad val.* under the General Tariff, goods the produce or manufacture of the United Kingdom and reciprocating British Possessions being admitted free of duty.

UNITED STATES OF AMERICA.—Collectors of Customs at United States ports are now authorised to issue export licences in respect of goods on the American prohibited export list originating in and shipped from the United Kingdom, France, or Italy, or their colonies, when dispatched *viâ* a United States port to such countries or their colonies, on presentation of a copy of the manifest covering the goods. Similarly, goods from Canada (by rail) in transit for the United Kingdom, France, or Italy, or their colonies, will also be licensed by Collectors.

UNITED STATES (PANAMA CANAL ZONE).—Official announcement has been made that all goods exported from canal zone ports must be licensed. Shippers should note that this applies not only to cargo originating in the zone, but to all cargo shipped from canal zone ports, irrespective of its origin.

FRANCE.—By a Ministerial Decree dated November 19th, the provisions of the Decree of February 12th, 1915, by which carbons for electrical purposes were allowed to be exported from France without special authorisation when destined for the United Kingdom, the British Dominions, &c., and certain foreign countries, have been abrogated. The exportation of these carbons is therefore now prohibited except under licence.

BAHAMAS.—By Act No. 10 of 1917 the surtax of 10 per cent. imposed in 1915 on all goods subject to *ad valorem* duties on their importation into the Colony is continued in force for a period of one year, and from thence to the end of the next Session of the Legislature.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

13,868. "Sparking plugs for internal-combustion engines." V. Perrett. August 26th.

13,869. "Commutators for use on internal-combustion engines." F. G. Hayward. August 26th.

13,870. "Means for receiving impulses and ascertaining their direction." R. A. Fessenden. August 26th. (U.S.A., August 16th, 1917.)

13,880. "Submarine signalling." R. A. Fessenden. August 26th. (U.S.A., July 20th, 1917.)

13,885. "Process for sherardising." S. O. Cowper-Coles. August 27th.

13,898. "Resistance." A. E. Vick. August 27th.

13,907. "Electric cigar or pipe-lighter." A. J. Roberts. August 27th.

13,922/3. "Electric transformers." S. Z. de Ferranti. August 27th.

13,931. "Sparking plugs for internal-combustion engines." H. R. Ricardo. August 27th.

13,934. "Standards for supports for electric lamps." A. E. Wilson. August 27th.

13,936. "Means for supporting electrical conductors." A. E. Wilson. August 27th.

13,940. "Magneto motor." D. Suchostawer. August 27th.

13,961. "Motor-starters, rheostats, &c." L. K. Vire. August 28th.

13,975. "Trolley heads of electrically-propelled vehicles." H. Dowden and J. J. Sampson. August 28th.

13,984. "Manufacture of natural graphite electrodes." E. Ridoni & Soc. Talco e Grafiti Val Chisone. August 28th. (Italy, March 6th.)

13,986. "Electric switches." C. R. C. Lyster, Newton & Wright and S. Russ. August 28th.

14,014. "Apparatus for moistening and treating air in connection with electric heater." H. C. Gover. August 29th.

14,039. "Reflector and heat-accumulator for gas and electric lighting and heating." H. Levi. August 29th.

14,040. "Electric cut-outs." C. C. Gerrard, A. H. Railing & W. E. Wilson. August 29th.

14,043/4. "Electric signalling lamps." W. H. Eggington & H. Lucas. August 29th.

14,045. "Electric switches." W. H. Edwards & H. Lucas. August 29th.

14,078. "Dynamo-electric machines." British Thomson-Houston Co. and H. W. Taylor. August 30th.

14,079. "Electric furnaces." A. D. Keene. August 30th. (U.S.A., September 5th, 1917.)

14,106. "Primary galvanic batteries with unalterable electrolyte." E. W. Jungner. August 30th. (Sweden, September 4th, 1917.)

14,114. "Plug-and-socket connections for electric circuits." W. H. Edwards & H. Lucas. August 30th.

14,144. "Utilisation of the currents produced in the earth as source of electrical energy." W. A. Rundle & L. S. Walton. August 31st.

14,148. "Electric lampholders." W. L. Bodman. August 31st.

14,154. "Controlling switches of combined ammeters and voltmeters." B. Brooks & W. Holt. August 31st.

14,155. "Appliance for engaging overhead conductor with trolley-sheave of electrically-propelled cars." W. H. Simmonds. August 31st.

14,160. "Electrical apparatus for detecting, &c., presence of high-tension of extra-high-tension sparks or discharges." N. Stell. August 31st.

14,165. "Safety gaps of ignition magnetos for internal-combustion engines." M-L. Magneto Syndicate & E. A. Watson. August 31st.

14,184. "Variable-speed alternating-current motors." J. D. Lewis. August 31st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

8,166. Electric traction systems. Ateliers de Constructions Electriques du Nord et de l'East. December 21st, 1915. (102,923.)

1917.

4,666. Electric battery indicating devices. A. E. White (Domestic Engineering Co., U.S.A.). March 30th, 1917. (117,906.)

11,109. Ceiling roses and like electrical fittings. J. C. White. August 2nd, 1917. (117,931.)

11,222. Dynamo-electric machines. Crompton & Co. and N. Pensabene. August 3rd, 1917. (117,934.)

11,235. Ignition dynamos. C. T. Mason. September 15th, 1916. (100,793.)

11,298. Means for supporting electrodes in ionic tubes for use more particularly in wireless telegraphy. Osram-Robertson Lamp Works & F. P. Driver. August 4th, 1917. (117,939.)

11,505. Electrical induction apparatus. British Thomson-Houston Co. (General Electric Co., U.S.A.) August 10th, 1917. (117,953.)

11,667. Automatic decelerating devices. British Thomson-Houston Co. (General Electric Co., U.S.A.) August 14th, 1917. (117,959.)

11,864. Telephone receivers. A. Matt. August 18th, 1917. (Cognate application, 16,231/17.) (117,967.)

11,909. Electric signalling systems, more particularly for use in mines. Automatic Telephone Manufacturing Co. & H. Green. August 20th, 1917. (117,969.)

12,357. Galvanic batteries. G. Oldham & J. Oldham. August 28th, 1917. (117,981.)

12,469. Phase advancers for dynamo-electric machines. British Thomson-Houston Co. & N. Shuttleworth. August 30th, 1917. (117,986.)

13,221. Electric ovens. K. Mjelva. September 14th, 1917. (117,996.)

13,780. Methods for melting refractory substances by electric arcs. J. G. Webb. March 6th, 1917. (115,017.)

14,814. Electric condensers. F. R. Simms & Simms Motor Units, Ltd October 12th, 1917. (118,009.)

15,010. Sparking plugs. J. E. Barrows. October 17th, 1917. (118,012.)

15,855. Electric cooking stoves. P. Watson. October 31st, 1917. (118,018.)

16,039. Means for completing an electric circuit, specially applicable to alarm clocks. H. O. Farrell & A. Ward. November 3rd, 1917. (118,020.)

16,321. Device for closing the orifices in the roof and walls of an electric furnace through which the electrodes pass. C. H., Watson and Co. & W. Travis. November 8th, 1917. (118,023.)

16,933. Electrically-operated overhead lifting gear. W. H. Vaughan, F. Wood & N. Baguley. November 17th, 1917. (118,031.)

17,162. Impulse transmitters for automatic telephones. H. Wilson. November 21st, 1917. (118,034.)

19,322. Electric heating apparatus. W. J. Mellersh-Jackson (L. V. Leonard and A. J. Allen). December 31st, 1917. (118,048.)

1918.

617. Electric starting apparatus for motor-vehicle engines. H. Lucas and C. L. Breeden. January 10th, 1918. (118,050.)

2,907. Electric relays, particularly for traffic-controlling apparatus. McKenzie Holland & Westinghouse Power Signal Co. February 20th, 1917. (113,615.)

3,414. Electric accumulators. H. Dean & Chloride Electrical Storage Co. February 26th, 1918. (Addition to 15,815/17.) (118,063.)

4,098. Carriers for cable-way systems. H. Thorne. March 8th, 1918. (118,065.)

An E.T.U. Treasurer Charged.—At Barrow-in-Furness Police Court, last week, Francis Furness (36), the treasurer of the Barrow branch of the Electrical Trades Union, was charged on remand with falsifying the branch's Post Office Savings Bank pass book, with embezzling certain sums of money, and with forging the initials of a postmistress and the date stamp of the branch post office in Rawlinson Street, Barrow. Accused, when asked whether he had anything to say, replied :—"Just to plead not guilty, sir, that is all." The Bench decided to commit him for trial at the next Lancaster Assizes. Bail was granted in one surety of £300, or two of £150.